DON OTHMER'S 90th BIRTHDAY (see page 9)

CHEMICAL HERITAGE

VOLUME 11 ■ NUMBER 2 ■ SUMMER 1994

ACS Unveils First National Historic Chemical Landmark

50

In ceremonies held on 9 November 1993 at the National Museum of American History in Washington, D.C., Helen M. Free, president of the American Chemical Society, unveiled a plaque designating the Bakelizer as the first National Historic Chemical Landmark. The Bakelizer is the original piece of process apparatus used by Leo Baekeland in 1909 to commercialize Bakelite, the first totally synthetic plastic. Among the special guests present at the Smithsonian's Information Age Theater were Parvez Wadia, vice president of Union Carbide, which donated the Bakelizer to the Smithsonian in 1983; Larry Thomas, president of the Society of the Plastics Industry; Harold Holz and Robert Sherman of Plastics Pioneers; and Jack Keville, vice president of the National Plastics Center and Museum. John Sharkey represented the ACS New York Section, where Baekeland (who died fifty years ago, in 1944), announced his invention on 8 February 1909, while serving as the section's chair.

Free described the program in the following remarks.

"The ACS National Historic Chemical Landmarks Program [NHCLP] operates at the grassroots level, with local section and division members identifying milestones, documenting their importance, and nominating them for official ACS designation. The Chemical Heritage Foundation cooperates with the landmarks program to assist ACS members in researching and documenting their

Continued on page 22

A new home for CHF and its Othmer Library in Philadelphia's Historic District.

CHF Approaches Independence

INDEPENDENCE HALL, the Liberty Bell, the First and Second Banks of the United States, Library Hall, the American Philosophical Society, and a whole slew of museums and libraries known to scholars and visitors from around the globe. Add the benign ghosts of Benjamin Franklin, Thomas Jefferson, William Penn, and other fabled architects of American Independence and of the Commonwealth of Pennsylvania—passionately devoted to human betterment in all its manifestations and to both reflection and action. The result is Independence National Historical Park in Philadelphia. What more suitable location could there be for the permanent home of CHF and its Othmer Library?

The saga that began in 1987 with Don Othmer's bold vision of a great research library is now reaching its exciting culmination. By mid 1993 the conclusion had been reached that given the current depressed real-estate market, now was the time to *buy*. And sufficient resources were in hand to bid on the purchase of one of the classic bank buildings on Chestnut Street, the former banker's row.

The site chosen is that of the former First National Bank; it includes a vacant lot open for future possibilities. As is fitting for the home of the Chemical Heritage Foundation, the building itself is historically certified. Still more exciting, CHF's new location is immediately adjacent to Franklin Court, the site of Ben Franklin's Philadelphia home, now a Federal Museum dedicated to his activities as educator, scientist, entrepreneur, and civic leader.

Stay tuned!

FOUNDING SOCIETIES: AMERICAN CHEMICAL SOCIETY ■ AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

AFFILIATED SOCIETIES: THE ELECTROCHEMICAL SOCIETY, INC. ■ THE CHEMISTS' CLUB ■ AMERICAN SOCIETY FOR MASS SPECTROMETRY ■ SOCIÉTÉ DE CHIMIE INDUSTRIELLE ■ THE AMERICAN ASSOCIATION FOR CLINICAL CHEMISTRY, INC. ■ ALPHA CHI SIGMA FRATERNITY ■ AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS ■ THE AMERICAN INSTITUTE OF CHEMISTS, INC. ■

CHEMICAL HERITAGE FOUNDATION

THE CHEMICAL HERITAGE FOUNDATION (CHF) was established by joint action of the American Chemical Society and the American Institute of Chemical Engineers. Affiliated organizations include Alpha Chi Sigma, The American Association for Clinical Chemistry, Inc., the American Association of Textile Chemists and Colorists, the American Institute of Chemists, Inc., the American Society for Mass Spectrometry, The Chemists' Club, The Electrochemical Society, Inc., and the Société de Chimie Industrielle.

CHF seeks to advance the heritage of the chemical sciences by discovering and disseminating information about historical resources; encouraging research, scholarship, and popular writing; publishing resource guides and historical materials; conducting oral histories; creating traveling exhibits; and taking other appropriate steps to make known the achievements of chemical scientists and the chemical process industries.

CHF operates through public outreach programs and through the Arnold and Mabel Beckman Center for the History of Chemistry and the Donald F. and Mildred Topp Othmer Library of Chemical History.

DIRECTOR
ARNOLD THACKRAY

ASSISTANT DIRECTORS
IRENE I. LUKOFF
JAMES J. BOHNING

LIBRARIAN
AMY DeCARLO

FIELD ARCHIVIST
TIM KERNAN

PROJECT MANAGER
GARDNER A. CADWALADER

EDELSTEIN INTERNATIONAL STUDENT
JAMES A. ALTENA
University of Chicago

EDITOR
THEODOR BENFEY

PUBLICATIONS MANAGER
FRANCES KOHLER

EDITORIAL CORRESPONDENTS
WILLIAM H. BROCK
University of Leicester
YASU FURUKAWA
Tokyo Denki University
ELMER L. GADEN, Jr.
University of Virginia
CHRISTOPH MEINEL
University of Regensburg
MARY JO NYE
University of Oklahoma
ANTHONY S. TRAVIS
Edelstein Center, Jerusalem

CHF BOARD OF DIRECTORS

BOARD MEMBERS
CHARLES C. PRICE
(Chairman) At large
STUART W. CHURCHILL
At large
JOSEPH A. DIXON
American Chemical Society
ELMER L. GADEN, JR.
American Institute of Chemical Engineers
NED D. HEINDEL
American Chemical Society
ROALD HOFFMANN
At large
SHELDON E. ISAKOFF
American Institute of Chemical Engineers
ALEC JORDAN
At large
PAUL L. KOHNSTAMM
At large
C. MARVIN LANG
American Chemical Society
ARTHUR B. METZNER
American Institute of Chemical Engineers
PAUL C. MILNER
The Electrochemical Society, Inc.
L. JOHN POLITE, JR.
The Chemists' Club
HERBERT T. PRATT
American Association of Textile Chemists and Colorists
HOWARD E. SIMMONS, JR.
At large

OBSERVERS
PAUL F. COPP
Société de Chimie Industrielle
ROBERT S. MELVILLE
The American Association for Clinical Chemistry, Inc.
E. GERALD MEYER
The American Institute of Chemists, Inc.
LAWRENCE R. PHILLIPS
American Society for Mass Spectrometry
DAVID A. H. ROETHEL
Alpha Chi Sigma Fraternity

EX-OFFICIO
ARNOLD THACKRAY

CHF ADVISORY BOARD
CHRISTIAN B. ANFINSEN
The Johns Hopkins University
HERBERT C. BROWN
Purdue University
GORDON F. BRUNNER
The Proctor & Gamble Company
JOHN B. BUSH, JR.
The Gillette Company
GORDON A. CAIN
The Sterling Group
VINCENT A. CALARCO
Crompton & Knowles Corporation
SIDNEY M. EDELSTEIN
Dexter Chemical Corporation
ARNOLD FRANKEL
Aceto Corporation
THOMAS L. GOSSAGE
Hercules, Inc.
JOHN C. HAAS
Rohm and Haas Company
JEAN M. HEUSCHEN
General Electric Plastics
ALAN R. HIRSIG
ARCO Chemical Company
JON M. HUNTSMAN
Huntsman Chemical Corporation
ROBERT D. KENNEDY
Union Carbide Corporation
RALPH LANDAU
Stanford University
DALE R. LAURANCE
Occidental Petroleum Corporation
BRIAN W. METCALF
SmithKline Beecham Corporation
JOSEPH A. MILLER
DuPont
PETER J. NEFF
Rhône-Poulenc Inc.
JOHN F. NIBLACK
Pfizer Inc.
MARY JO NYE
University of Oklahoma
JOHN D. ONG
The BFGoodrich Company
FRANK P. POPOFF
The Dow Chemical Company
CHARLES C. PRICE
University of Pennsylvania
GLENN T. SEABORG
University of California, Berkeley
C. J. SILAS
Phillips Petroleum Company
S. JAY STEWART
Morton International, Inc.
P. ROY VAGELOS
Merck & Co., Inc.
J. LAWRENCE WILSON
Rohm and Haas Company
WILLIAM WISHNICK
Witco Corporation

CHF COUNCIL OF FRIENDS
HOWARD E. SIMMONS, JR.
(Chairman) DuPont
FRED AFTALION
A.L.E.P.S.
RUTHERFORD ARIS
University of Minnesota
ALFRED R. BADER
Sigma-Aldrich Corporation
WILLIAM O. BAKER
AT&T Bell Laboratories
DEREK H. R. BARTON
Texas A & M University
PETER A. BENOLIEL
Quaker Chemical Corporation
VERNON BISHOP
Lebanon Chemical Corporation
ALFRED D. CHANDLER, JR.
Harvard University
MILDRED COHN
University of Pennsylvania
ELIAS J. COREY
Harvard University
CARL DJERASSI
Stanford University
HERBERT D. DOAN
Herbert & Junia Doan Foundation
BRYCE DOUGLAS
SmithKline Beecham Corporation
IRÉNÉE DU PONT, JR.
Crystal Trust
JOHN T. EDSALL
Harvard University
ERNEST L. ELIEL
University of North Carolina, Chapel Hill
JAMES R. FAIR
University of Texas, Austin
LOUIS FERNANDEZ
Celgene Corporation
EUGENE GARFIELD
Institute for Scientific Information
THOMAS G. GIBIAN
Henkel Corporation
MARY L. GOOD
Allied Signal Incorporated
J. PETER GRACE
W. R. Grace & Co.
HARRY B. GRAY
Beckman Institute, California Institute of Technology
B. DAVID HALPERN
Materia Medica, Inc.
WILLIAM H. HELFAND
Merck & Co., Inc.
ERWIN N. HIEBERT
Harvard University
RALPH F. HIRSCHMANN
Merck & Co., Inc.
ROALD HOFFMANN
Cornell University
HOYT C. HOTTEL
Massachusetts Institute of Technology
AARON J. IHDE
University of Wisconsin
EDWARD G. JEFFERSON
DuPont
FRANKLIN A. LONG
University of California, Irvine
JERRY McAFEE
Gulf Oil Company
DONALD F. OTHMER
Polytechnic University
LINUS PAULING
Linus Pauling Institute of Science & Medicine
LEWIS H. SARETT
Merck & Co., Inc.
JOHN H. SEINFELD
California Institute of Technology
PETER SPITZ
Chem Systems, Inc.
F. WILLIAM SUNDERMAN, SR.
Institute for Clinical Science
D. STANLEY TARBELL
Vanderbilt University
NORMAN J. TRAVIS
U.S. Borax & Chemical Corporation
GLENN E. ULLYOT
SmithKline Beecham Corporation
FRANKLIN J. VAN ANTWERPEN
American Institute of Chemical Engineers
JAMES WEI
Princeton University

Are We Seeing a Chemical Renaissance?

"Key to Winning: Chemistry 101" is the title of sports commentator Jerry Izenberg's column in the 12 October 1993 *Philadelphia Inquirer* on the New York Giants playing football against the Washington Redskins. "The key to winning? Chemistry," said starting center Bart Oates. And Izenberg commented of the Dallas Cowboys that they "seemed to develop that kind of chemistry."

This and other straws in the wind show we need not fear that chemistry has become almost a swear word, evocative of pesticides and pollution. Perhaps that era is passing. The *New York Times Book Review* 26 September 1993 devoted a full page to praising *The Norton* (in Great Britain, *Fontana*) *History of Chemistry*, written by William H. Brock—largely while he was Edelstein Fellow at CHF in 1990–91. The reviewer described it as a book to be read by the literate public. And even more amazing, on the following Sunday the editor's choice column "And Bear in Mind," after the list of best sellers, drew attention again to Brock's book, commenting that "a discipline that has formed society far more than any war or revolution is here made clear and accessible."

If that coverage were not enough, it was followed on 4 November by a seven-page review, entitled "The Poet of Chemistry," of David Knight's *Humphry Davy* (Blackwell) in the *New York Review of Books* by the renowned neurologist and writer Oliver Sacks, author of *Migraine* and *The Man Who Mistook His Wife for a Hat*. Sacks tells of his own fascination since boyhood with chemistry and with Davy, describes Davy's friendship with Coleridge and Wordsworth, and emphasizes the humanity of scientists. In his final note he also draws attention to Brock's book and concludes, "Both Knight and Brock bring to their subject an interpretive intensity and narrative power. . . . [T]heir books represent a new form of scholarship, which removes the history of science from the merely scholastic and makes it urgently and vividly relevant to us now."

Even among historians of science, the history of the chemical sciences seems to be on the upswing. The Santa Fe annual meeting of the History of Science Society (HSS) last November featured a remarkable collection of papers related to the chemical sciences, including three symposia: "Controlling Chemical Knowledge: Chemistry Beyond the Laboratory" (Andrew Ede, Trevor Levere, Hannah Gay); "Chemistry across European Borders: Comparative Studies" (Seymour Mauskopf, chair; Alan J. Rocke, France and Germany; Nathan Brooks, Germany and Russia; Mary Jo Nye, France, England, etc.); and "Theology, Metaphysics and Alchemy in the Thought of Robert Boyle" (Margaret J. Osler, Ron Levy, Jan Wojcik, J. J. MacIntosh, Jane E. Jenkins, Lawrence Principe). In addition Bernadette Bensaude-Vincent reported on "Lavoisier and His Historians," and William Newman headed a roundtable discussion on the nonexact sciences from the Middle Ages to the Scientific Revolution in which he represented alchemy and iatrochemistry. Not least, the fledgling History of Chemistry Interest Group of the HSS held a well-attended dinner and reception at that same Santa Fe meeting.

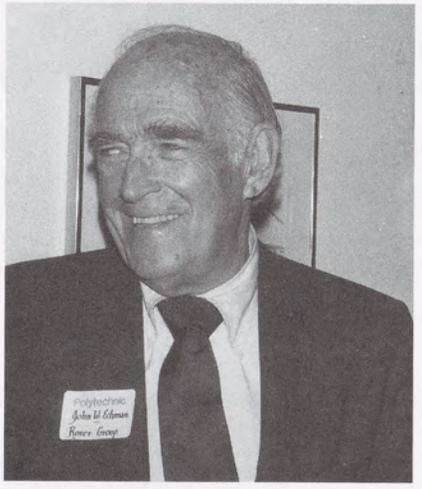
Professional scientists also are taking note. A front-page story in *The Scientist* (15 Nov. 1993), "History of Science Societies Sprout Up Nationwide With More Researchers Studying Lessons of the Past," prominently features the work of CHF and similar history of science centers and quotes CHF's director, Arnold Thackray.

Returning finally to where we began, the *Philadelphia Inquirer* led off its 27 December 1993 Business Section with a detailed profile of CHF entitled "Famous Chemists Are Also Providing Some Lessons in History."

Theodor Benfey

?

Editor's note: The hexagons with numerals placed throughout this issue mark various chemical anniversaries. See especially pages 21 to 23, including our Chemical Dateline.



John W. Eckman, pharmaceutical and civic leader.

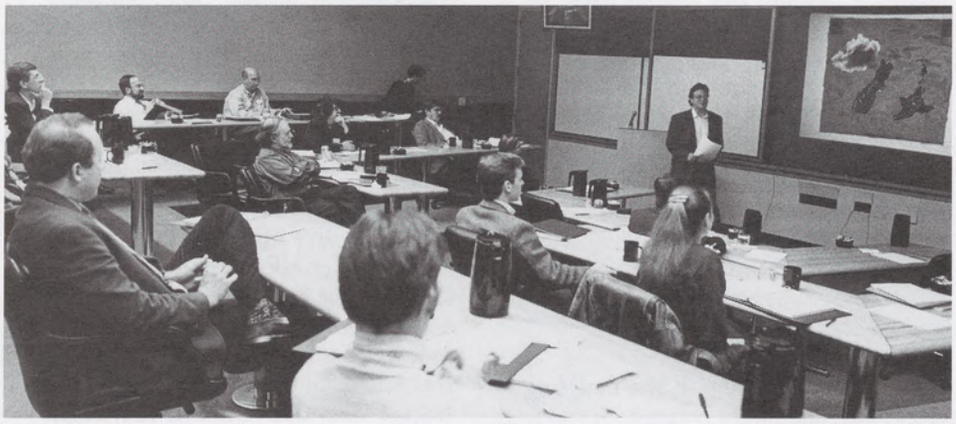
CHF Loses a Friend

In the death of John W. Eckman, former chief executive officer of the Rorer Group Inc., CHF loses one of the most dedicated of its supporters. Together with John C. Haas of Rohm and Haas and Charles C. Price, a past president of the American Chemical Society, he helped steer CHF from its first beginnings, when it was organized in response to a 1980 ACS task force led by Ned Heindel (the 1994 ACS president), to its present status as the "heritage arm" of the American chemical community. John Eckman chaired the CHF Development Committee from its inception. His wide knowledge of the chemical process industries, his considerable experience in philanthropy, his drive, and his judgment were instrumental in the creation of the Beckman Center and the Othmer Library, and in guiding CHF in its search for a permanent home. We will miss him greatly.

John Eckman (left), at an early Advisory Board Meeting in August 1984, with Arnold Thackray and Fred Basolo.

NEWS from the Arnold and Mabel Beckman Center for the History of Chemistry

The Beckman Center is sponsored by the Chemical Heritage Foundation and the University of Pennsylvania. The Center is an academic unit of Penn, working closely with the Department of History and Sociology of Science and with the Departments of Chemistry, Chemical Engineering, and Biochemistry and the Laboratory for Research on the Structure of Matter. The Center's mission is to undertake scholarly research, publish materials on the history of the chemical sciences, support senior-level and graduate fellowships, and conduct a variety of scholarly events of interest to the academic community.



Participant Michael Fortun (Cornell) speaks at the BIMOSI conference on "Private Science." Others in the picture include Daniel J. Kevles (Caltech), Jeffrey L. Sturchio (Merck), Thomas F. Gieryn (Indiana), Glenn E. Bugos, Sheldon Krimsky (Tufts), Stephen Hilgartner (Columbia), and Lily E. Kay (MIT).

BIMOSI Conference on Biotechnology: A Report

What is biotechnology? Does history tell a more complex story than the conventional wisdom that molecular biology has been transformed from a basic science with little market value to a commodity at the focus of patent disputes? What role has government played in the economic success or failure of genetic engineering? These are some of the questions addressed by participants in the conference "Private Science: The Biotechnology Industry and the Rise of Contemporary Molecular Biology," held 28–30 October 1993 at the Eagle Lodge Conference Center north of Philadelphia. This first-ever conference on the development of a key modern science-cum-industry was part of the Beckman Center's Biomolecular Sciences Initiative (BIMOSI), with the support of the Andrew W. Mellon Foundation.

The meeting brought together a distinguished international group of historians, sociologists, and policy analysts in a secluded setting conducive to constructive discussion. The first presentations set forth issues that recurred throughout the three days. Robert Bud (National Museum of Science and Industry, London) opened the program by unearthing the history of German, British, and American "zymotechnology" and what he called the "prehistory" of biotechnology. Today's activity has intellectual links to industrial fermentation in the late nineteenth century, he argued. Thus to trace the emergence of molecular biology as a key science and the rise of the "new" biotechnology after 1970, one needs to look first at biochemistry and its complex ties to industry. Daniel J. Kevles (California Institute of Technology) sounded a second key theme, by addressing the patenting of living organisms, focusing on the case of Diamond v. Chakrabarty, in which a patent was awarded for a bioengineered bacterium. Glenn E. Bugos (Redwood City, California) outlined a century of U.S. government policy on biodiversity, particularly in relation to agriculture.

The meeting next turned to a series of case studies in the history of molecular biology that highlighted the links and the discontinuities between the 1930s, 1940s, 1950s, and today. Angela N. H. Creager (Massachusetts Institute of Technology) discussed the wartime blood plasma fractionation project of Edwin J. Cohn, at Harvard University, between 1940 and 1953. Cohn's research entailed large-scale collaboration between the university and several pharmaceutical companies. Lily E. Kay (Massachusetts Institute of Technology) focused on the role of the Rockefeller Foundation in funding molecular biological research, and argued that its programs fostered a new, technological view of life that set the cultural stage for the biotechnology industry four decades later. Pnina G. Abir-Am (Centre de Recherche en Histoire des Sciences et des Techniques, La Villette, Paris) compared the experiences of Jacques Monod and Ernest Chain as biotechnological entrepreneurs involved in the commercialization of the products and processes they invented.

Another group of scholars focused on the politics and economics of biotechnology. Susan Wright (University of Michigan) discussed molecular politics in a global economy, focusing on the United Kingdom. Herbert Gottweis (Cornell University) pointed to the problems of state intervention in developing the biotechnology industry, using the British attempt to form a national biotechnology policy as an example. Martin Kenney (University of California, Davis) suggested that in the 1970s changes in venture capital, molecular biology, and patent law combined to create a new economic space for the commercialization of molecular biology.

Sociologists at the conference turned their attention to issues of scientific practice. Alberto Cambrosio (McGill University) showed how the technique of producing monoclonal antibodies spread through a network of practitioners and was translated from a private into a public tool. Thomas F. Gieryn

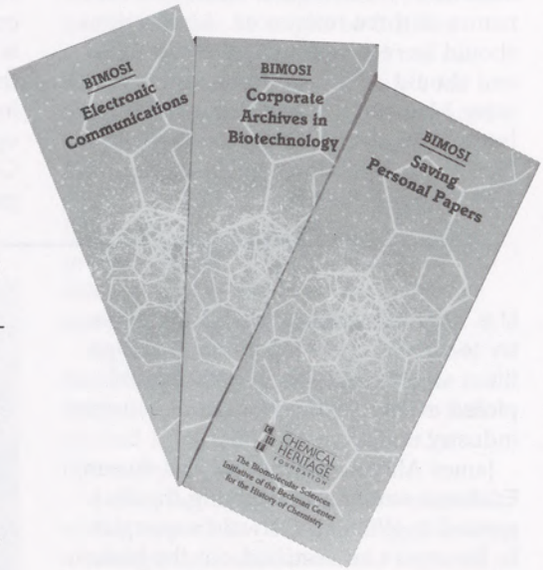
Above: Herbert Gottweis (Cornell) and Robert M. Goodman (Wisconsin) make their points in the discussion. Right: During a break in proceedings, Norton Zinder (Rockefeller University) and Daniel J. Kevles (Caltech) pose for our camera.

(Indiana University) presented his observations of new biotechnology buildings, arguing that questions about whether the science is pure or applied, public or private, are resolved in the physical construction of laboratories; he also suggested that the place where research is done influences the questions scientists ask. Stephen Hilgartner (Columbia University) drew on ethnographic studies of scientific laboratories in a discussion of how researchers regulate access to data in molecular genetics. Michael Fortun (Cornell University) analyzed the rhetoric surrounding the Human Genome Project to suggest that speed forms an integral part of the project—rather than "big science," it might be better characterized as "fast science."

The conference concluded with a session on public versus private issues in agricultural biotechnology. Robert M. Goodman (University of Wisconsin, Madison), drawing on his experiences as a scientist in both academia and industry, pointed out that few plant biotechnology products have made it to market, and that they rely heavily on publicly funded research. Mark Lesney (University of Florida, Gainesville) gave an account of how, in the late 1970s, land-grant colleges embraced biotechnological approaches as a solution to the poor public image of agricultural research. Sheldon Krimsky (Tufts University) gave the concluding paper of the conference, an analysis of popular images of biotechnology and their impact on debates over the safety, social value, and ethics of the products of genetic engineering.

Norton Zinder (The Rockefeller University) joined the roster of conference participants as a guest speaker after dinner on the second day of the conference. Zinder drew from personal experience to relay his view of how molecular biology developed over the last forty years.

In a final roundtable of a stimulating and productive meeting, participants discussed areas for future historical and sociological research. Kevles suggested that the history of agricultural research since hybrid corn remains to be written. Gottweis added that public criticism of biotechnology needs to be understood historically, as a process that polarizes public and private. Kay noted that little is known about modern pharmaceutical companies and that many corporate archives are closed to historians. Jeffrey Sturchio (Merck & Co.) suggested ways that historians can gain access to information about the individuals and companies they would like to study. In addition, one goal of the Beckman Center's BIMOSI project is to promote ties between the biotechnology industry and archivists so that the history of biotechnology can be written in the future.



Three BIMOSI-related leaflets are now available. They address the saving of personal and corporate papers and electronic mail. Single copies are available free of charge.

The Chemical Heritage Foundation intends to translate the conference proceedings into a book.

ELIZABETH HANSON

Brown-Bag Lunches

More Visitors from Abroad

Brown bag lunches, by now a tradition at CHF's Beckman Center, have been particularly lively and international this year. Last year Yasu Furukawa of Tokyo spoke twice, once on Japanese chemical technology and once on Hermann Staudinger and early polymer chemistry. By mid September three other foreign visitors had arrived for extended study visits. Each hosted one or more brown-bag lunches, informal presentations on their current work followed by discussion. Horst Remane, a historian of chemistry at the University of Halle in the former DDR, was on a six-month Leopoldina fellowship. After studying the Emil Fischer papers at the University of California, Berkeley, he came to CHF to work on the history of spectroscopy and on current materials for teaching history of chemistry. He reported on the upheavals and transformations in history of science faculties, research, and curricula as the former East and West Germanies recoalesce into a single country.

Continued on next page

BROWN BAG LUNCHES—*continued*

Michael Chayut, from the Hebrew University, Jerusalem, returned to CHF for two months of research on Paul Flory and others whose signal contributions can be linked to their early research in fields far from their training and initial interests. Flory, a physical chemist (Nobel Prize, 1974), conceived some of his key ideas in Wallace Carothers's polymer laboratory at Du Pont; Eugene P. Wigner, a nuclear physicist (Nobel Prize, 1963), arrived at his conclusions in the Kaiser Wilhelm Institute for Fiber Research. Chayut first spoke on his expanding studies of such "peripheries" as significant loci for innovation; the following week, in "Science and Tragedy," he explored the inherent dichotomy between the—basically optimistic—scientific temper and the tragic sense of life, one or the other tending to predominate in any given period of history.

William Brock, Edelstein International Fellow in 1990–1991, returned from England for a month. He surveyed for us the life of the chemist Edith Hilda Usherwood (1898–1988), wife of Christopher Ingold. She is one of several British women chemists who early in the century maintained their careers by assisting and collaborating with male chemists. Brock is currently writing a biography of Justus Liebig.

Masurium or Technetium?

A more fleeting visitor was Pieter van Assche of the physics department of the University of Leuven (Louvain), who reported on his search for the first discoverer of element 43. Walter Noddack, Ida Tacke Noddack, and Otto Berg claimed the discovery of 43 (which they called masurium) and 75 (rhenium) in 1925, but only rhenium was recognized. Emilio Segré and Carlo Perrier rediscovered element 43 as a product of nuclear bombardment and renamed it technetium; others recovered it later from uranium fission. The Noddacks stated that they found element 43 only in uranium ores, where Assche believes it was present as a spontaneous uranium fission product.

Edelstein Students Report

Returning to CHF to report on the progress of her dissertation, Kathryn Steen, our first Edelstein International Student, described the efforts of the still fledgling U.S. synthetic organic chemicals industry to survive renewed German competition after World War I. Her talk explored examples of cooperation between industry and government.

James Altena, our second and current Edelstein student, is studying the background to Wilhelm Ostwald's energism. In his report he sketched out the historical development of static and dynamic approaches to understanding chemical phenomena—from the pre-Socratics to the philosophy of Friedrich Schelling.

GRANTS & AWARDS

Edelstein International Fellowship

Applications are invited from established scholars for the 1995–1996 Edelstein International Fellowship in the History of the Chemical Sciences and Technology. The Edelstein Fellow will be expected to divide his or her time between residency at the Chemical Heritage Foundation (CHF) in Philadelphia and the Edelstein Center for History and Philosophy of Science, Technology, and Medicine in Jerusalem. The resources of the Edelstein Library (especially strong in all aspects of chemical history) will be available to the holder in Jerusalem. Philadelphia resources include the Othmer Library of Chemical History, the Edgar Fahs Smith Collection, and the Library of the American Philosophical Society. The major portion of the fellow's time will be devoted to research, but the fellow will also contribute to the work of each institution in an appropriate manner. The fellowship period is 1 September 1995 to 30 June 1996; it may be held in conjunction with other research or sabbatical support. A travel allowance is also available.

Letters of application should indicate how CHF and Edelstein Collection resources in the chemical sciences are relevant to the applicant's research; applicants should also enclose a financial statement, a curriculum vitae, and the names of three references. Applications should be received by 31 October 1994 and should be sent to Professor Seymour Mauskopf, Coordinator, Edelstein International Awards, Department of History, Duke University, Durham, NC 27708; phone (919) 684-2581.

Edelstein International Studentship

The Edelstein International Studentship is available to support dissertation research and writing in the history of the chemical sciences and technologies. Candidates should have fulfilled all requirements for the Ph.D. except the dissertation. The Studentship provides a stipend and travel and dissertation fee support for a five- to six-month residency in Philadelphia at the University of Pennsylvania and a three- to four-month stay at the Hebrew University of Jerusalem in the course of the academic year. Resources in Jerusalem and Philadelphia are as noted for the Edelstein Fellowship. Candidates for the 1995–96 Studentship should send applications to Professor Seymour Mauskopf, at the address given in the Fellowship announcement, by 31 October 1994. Applications should include a dissertation prospectus, a brief statement of research and writing plans for the year of the Studentship, a curriculum vitae, and the names and telephone numbers of two references.

The first Edelstein International Student (1992–93) was Kathryn Steen of the University of Delaware. Her dissertation focused on the development of the synthetic organic chemicals industry in the United States, 1910 to 1933 (see *Chemical Heritage* 10:2, Summer 1993, p. 6). The current Edelstein International Student is James Altena, a graduate student at the University of Chicago. He is working on his dissertation, "Science, Philosophy, and Social Reform in Imperial Germany," which focuses on the energism of Wilhelm Ostwald.

James Altena, 1993–94 Edelstein student

Travel Grants

The Chemical Heritage Foundation offers small travel grants to enable interested individuals to make use of the research resources of the Beckman Center for the History of Chemistry, the Othmer Library of Chemical History, and associated facilities.

Grants, which may be used for travel, subsistence, and copying costs, will not normally exceed $500. Applications should include a vita, a one-paragraph statement on the research proposed, a budget, and the addresses and telephone numbers of two references. Deadlines are 1 February for grants to be used April–June; 1 May for July–September; 1 August for October–December; and 1 November for January–March. Applications should be sent to Elisabeth Hunt, Chemical Heritage Foundation, 3401 Walnut Street, Philadelphia, PA 19104-6228, by 31 October 1994.

Other Grants

The American Philosophical Society offers a doctoral dissertation fellowship of $12,000 in the history of the physical sciences in the twentieth century. The **John Clarke Slater Fellowship** is open to candidates for the doctorate in the United States and abroad who plan to spend the fellowship year in association with an American university or research institution, and who have passed their preliminary examinations. The deadline is 1 December of each year. Write to Slater Fellowship, American Philosophical Society, 104 South 5th Street, Philadelphia, PA 19106-3387.

A new **Liebig-Wöhler Freundschafts Preis** of DM2000 for research in history of chemistry relating to Justus Liebig or Friedrich Wöhler will be awarded by the Göttinger Chemische Gesellschaft Museum der Chemie. The award was donated by Liebig's grandson, Wilhelm Lewicki. Contact Professor Herbert W. Roesky, Tammannstrasse 4, D-37077, Göttingen, Germany.

The Dexter Award
Joseph Fruton, Thomas Osborne, and Protein Chemistry

Joseph S. Fruton of Yale University, in his Dexter Award Address to the ACS Division of History of Chemistry, described the contributions of Thomas Burr Osborne (1859–1929), for long the leading American protein chemist. Fruton together with his wife Sofia Simmonds wrote the influential General Biochemistry *(1953). He recently published* The Skeptical Biochemist, *and earlier the highly acclaimed* Contrasts in Scientific Style: Research Groups in the Chemical and Biochemical Sciences *(see this journal, 10:2, Summer 1993, p. 16; and 9:1, Spring 1992, p. B-9). Excerpts from his address, which will appear in the* Bulletin for the History of Chemistry, *are given here.*

Thomas Burr Osborne was a Connecticut Yankee who spent his entire life in New Haven. . . . A year after he had received his Ph.D. [from Yale in 1881], Osborne joined the staff of the Connecticut Agricultural Experiment Station- . . . where he headed the Biochemical Laboratory until 1928. . . .

Osborne applied the methods of [Albrecht] Kossel and [Emil] Fischer to the analysis of several seed proteins. . . . Osborne [subjected the method] to a more rigorous examination than that conducted in Fischer's laboratory, and improved it greatly, [prompting Fischer to write] in 1912: "I consider it likely that because of their greater wealth the Americans will beat us in several fields . . . . However, we can withstand this competition for a time because of our greater inventiveness and more distinguished individual achievements. That the gentlemen in America are also rather presumptuous is nothing new to me."

[In 1909 Osborne] and Lafayette Benedict Mendel (1872–1935) initiated their famous joint studies on nutrition, . . . [including] such areas as the vitamin contents of various foods. . . .

Osborne attracted few postdoctoral guests, . . . only one from abroad. Albert Charles Chibnall (1894–1988) [came from] Imperial College, London [in the early 1920s; as he recalled in 1966]: "I had been warned by Mendel of [Osborne's] nervous temperament, and the possibility that he might be taciturn when we met, but he greeted me cordially and in a very short while I felt quite at ease. I think I touched a chord to which his nature readily responded, for in our first talk I mentioned my home background, and he recognized in me someone who had taken the same path as himself, embracing science in spite of family efforts to divert him to more practical pursuits."

As the successor of [Frederick Gowland] Hopkins (1861–1947) at Cambridge, . . . Chibnall followed the trail charted by Kossel, Fischer, and Osborne. By about 1940, however, . . . [he] had begun to see the demise of that approach. . . . [H]e suggested to a young postdoctoral student named Frederick Sanger that fluorodinitrobenzene might be a good reagent [to determine terminal amino acids in insulin.]

Thomas Burr Osborne

The rest is well-known history. The analytical chemistry of proteins, begun during the 1830s by Gerrit Mulder and Justus von Liebig, was completed during the 1950s by Sanger and by Stanford Moore and William Stein. In this transmission of a chemical heritage, the role of Thomas Burr Osborne deserves to be remembered.

The Dexter Award, given annually by the American Chemical Society's Division of History of Chemistry, honors outstanding accomplishment in the history of chemistry. For instructions or to send nominations (due 1 February 1995) write William B. Jensen, Department of Chemistry, University of Cincinnati, Cincinnati, OH 45221-0172.

When I First Met a Computer

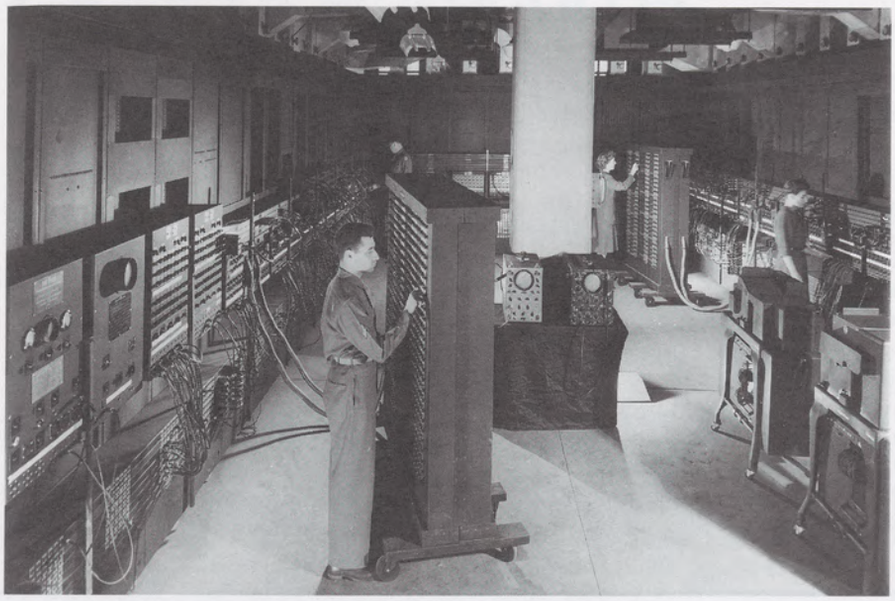
I'll never forget the first time I was privileged to come face to face with a computer. The year was 1958. Charged with doing something to help the Army Chemical Corps get a handle on its burgeoning mound of chemical information, I had begun exploring the various alternatives available for achieving "mechanization." This first meeting occurred in the basement of an off-limits building in Edgewood Arsenal, Maryland, where after passing through a security check, I was permitted to approach a large room, about double the size of our living room at home.

I opened the door, stepped up to a false metal floor over a thick black cable, and found I was in a corridor. Here I could get a look at the computer itself, but at a distance, separated by glass. In front was a machine the attendant who took me in charge said was a punched-card sorter. Beyond were several blue metal boxes with spinning wheels of tape visible. There were other metal-encased things that were not readily identifiable. Black wires were coiled everywhere. The false floor in the corridor, I was told, overlaid the cables that connected the machines to the power source, and also contained the temperature and humidity control channels.

It was here that I learned how cantankerous the computers of the day could be. Suddenly everything shut down, including the air-conditioning. The staff scrambled here and there in a panic, and I was hustled out, feeling I might have been to blame.

A few months later I attended an orientation session at IBM's "Mansion" at Poughkeepsie, along the Hudson River above New York City. There the various classes of mechanized equipment were identified. It was obvious that although punched-card sorting was still the mainstay, a leap upward was soon coming, and if I was to succeed in my mission of improving the handling of chemical information I had to pay attention to the coming computer revolution.

Not only did I learn something about computers—at least to recognize them—I also experienced the influence of IBM's Thomas Watson whenever I entered my room at the inn, where I saw a placard reminding me that alcoholic drinks were taboo, or encountered a motto hanging on the wall with the word THINK emblazoned on it.



One of the early mammoth computers—the ENIAC. Courtesy of the University of Pennsylvania School of Engineering and Applied Science.

There also was serendipity. One evening after classes we were invited to try our hand at playing tic-tac-toe with the computer. One after another tried and quickly lost. Although I shrank from displaying my ignorance and timidity, my hosts would accept no less than that everyone try it. The game started. Unexpectedly, I got all three X's in a row and won the game, to the amazement of the hosts and the shock of one young man in particular, who pointed out that the computer had never lost. "How did you do it? What did you do there?" he kept asking. Not knowing what I had done, I could not help him. He was the one who had created that program.

But I learned something from that episode. The computer's ability to perform comparisons, additions, and subtractions with lightning speed was subject to the quality and completeness of the programs or instructions that governed its operation. This insight served me well at the National Science Foundation in the mid 1960s, when I was a Project Officer in charge of a cooperative effort with the Department of Defense and the National Institutes of Health. Our mission was to help the Chemical Abstracts Service of the American Chemical Society develop a computer-based system for registering chemical compounds. The White House Office of Science and Technology supported the effort, recognizing the ACS's "unique responsibility to the discipline of chemistry," and aware that the system would speed retrieval for all government agencies that needed chemical information.

During that period, generally before the age of the silicon chip, I had the opportunity of dealing with computers at the Chemical Abstracts Service and at a number of university research operations—but no meetings were as exciting as those in 1958.

PAUL D. OLEJAR
Gaithersburg, Maryland

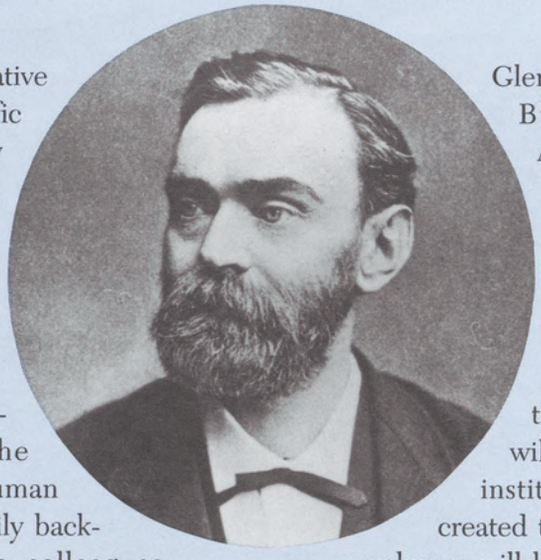
Chemical History at All Grade Levels

The International Newsletter on Chemical Education, for June 1993 announces plans to develop an internationally acceptable set of definitions and descriptions of several hundred key chemical terms. A dozen draft descriptions are included, among them those for *acid, atom, chemical bond, mixture* and *oxidation.* The origins and historical development of each term are discussed in words suitable for teaching young people at different age levels. The program is sponsored by the Committee on Teaching of Chemistry of the International Union of Pure and Applied Chemistry; it is headed by J. D. Bradley of the Chemistry Department, University of Witwatersrand, Johannesburg, South Africa.

Announcing the first volume in the History of Modern Chemical Sciences Series

NOBEL LAUREATES IN CHEMISTRY 1901–1992

Laylin K. James, Editor
History of Modern Chemical Sciences Series
Jeffrey L. Sturchio, Series Editor



This authoritative and informative volume examines the scientific achievements in chemistry for which the Nobel Prize has been awarded. Biographies of all 115 Nobel laureates, along with photos and references to the laureates' most significant publications provide a "snapshot" look at each of the scientists. In addition to exploring scientific achievements, the biographies also illuminate the human side of the individuals—their family backgrounds and lives. In many cases, colleagues, coworkers, or former students of the laureates have been enlisted as contributors, and all living laureates have reviewed their entries for accuracy.

Organized chronologically, *Nobel Laureates in Chemistry* takes the reader from J. H. van't Hoff, named the first chemistry laureate in 1901 for his work in chemical kinetics and osmotic pressure, to Rudolph Marcus, 1992 Nobel Prize recipient for his contributions to the theory of electron transfer reactions in chemical systems. Along the way readers will be fascinated by biographies of such notable researchers as Marie Curie, Dorothy Hodgkin, Irving Langmuir, Glenn Seaborg, Linus Pauling, Robert Burns Woodward, Emil Fischer, Alfred Werner, Ernest Rutherford, and many others.

Nobel Laureates in Chemistry is the first volume in the History of Modern Chemical Sciences Series. The series, co-published by the American Chemical Society and the Chemical Heritage Foundation, will document the individuals, ideas, institutions, and innovations that have created the modern chemical sciences. The volumes will bring the best historical scholarship on these topics to a wide audience among both the scientific community and the general public, providing the reader with a balanced view of the contributions chemistry and chemical technology have made to modern science and culture.

Nobel Laureates in Chemistry 1901–1992
Laylin K. James, Editor
History of Modern Chemical Sciences Series
650 pages (1993)
Clothbound: ISBN 0-8412-2459-5 $69.95
Paperbound: ISBN 0-8412-2690-3 $34.95

To order books, see the order form on page D

Chemical Sciences in Society Series

From the University of Pennsylvania Press

A History of the International Chemical Industry

Fred Aftalion; translated by Otto Theodor Benfey; preface by Patrick McCurdy

"The scope of subject matter treated in the present volume is truly enormous, and only an author with extraordinary resources could hope to bring it into order. Aftalion is such an author, having more than thirty years held commanding positions in the European chemical industry. . . . The style is conversational but the quantity of factual information is prodigious. . . . It should be read by all who claim an interest in the chemical industry and its wide-embracing history"—*History of Science.*

"Aftalion's masterly study presents an international perspective, integrates the story of chemical science with that of chemical industry, and emphasizes 20th-century developments. . . . He has packed an incredible amount of material into this vast, fascinating panorama of the contributions of ubiquitous, everyday products of literally hundreds of scientists and industrialists as well as hundreds of chemical companies in dozens of different countries, all admirably placed in their scientific and socio-political contexts"—*Journal of Chemical Education.*

1991. 440 pp, 48 illus. Cloth, ISBN 0-8122-8207-8, $46.95; paper, ISBN 0-8122-1297-5, $15.95

The American Synthetic Rubber Research Program

Peter J. T. Morris; foreword by Arnold Thackray

"A very readable account of the war-time project . . . . This well researched and referenced book covers the technology of the development, which has its own fascination. But perhaps even more fascinating are the descriptions of the organizations and of the people involved in the program. . . . Morris has produced an excellent analysis of the lessons to be learnt from the story. His book should be made compulsory reading for anyone involved in such multi-party programs"—*Chemistry and Industry.*

"This book on the synthetic rubber program sponsored by the U.S. government demonstrates [Morris's] tenacious ability to seek out not only standard authorities but also a mass of relevant information not readily available, to record the recollections of surviving participants, to make a critical appraisal of it all and present the essence clearly and succinctly for the general reader"—*Ambix.*

1989. 204 pp. Cloth, ISBN 0-8122-8205-1, $39.95

Chemical Sciences in the Modern World

Edited by Seymour H. Mauskopf

It would be difficult to overestimate the importance of the chemical sciences to the modern world. In the last 150 years, they have transformed our physical environment, our material culture, our manner of living, and even our persons—and they are continuing to do so in profound ways. Yet the detailed and systematic study of the history of the modern chemical sciences has been relatively late in coming.

This compilation of essays by leading scholars represents the first fruits of modern historical scholarship. The essays in Part One deal with the experimental generation of new chemical knowledge, the nature of theories about chemical knowledge, and the reception of new knowledge and theories by the chemical community. Part Two is devoted primarily to the development of modern industrial chemistry. Part Three is concerned with preserving archives and artifacts owned by public and private institutions, with making the history of chemistry accessible to persons interested but not trained in history, and with helping both policy-makers and the general public to understand policy issues involving the chemical sciences and industries through the insights provided by historical research. Part Four, the concluding section, discusses future prospects for the history of chemistry, addressing questions about methodology, audience, and new directions for research.

Chemical Sciences in the Modern World is sponsored by the Beckman Center for the History of Chemistry, established in 1982 at the University of Pennsylvania under the directorship of Arnold Thackray.

1994. 448 pages, 14 illus. Cloth, ISBN 0-8122-3156-2, $39.95

Photo: Total Chimie's petrochemicals complex in Gonfreville near Le Havre. Courtesy of Total Chimie.

To order books, see the order form on page D

More From The Chemical Heritage Foundation

From Vital Force to Structural Formulas
O. Theodor Benfey

"[The] only available in-depth treatment of the development of structural organic chemistry to feature translated excerpts from the original literature."

– Journal of Chemical Education

Theodor Benfey's *From Vital Force to Structural Formulas* traces the transformation of organic chemistry from 1800 to the work of Archibald Scott Couper and August Kekulé. The book also notes the major gaps in the structural theory they developed that were filled by later chemists. First published by Houghton Mifflin in 1964 and reprinted by the American Chemical Society in 1975, this invaluable teaching tool is at last back in print.

1992. xii + 116 pp, figs.
Index, chapter-by-chapter bibliographies.
Paper, 6 x 9, ISBN 0-941901-09-2
$15.00

Classics in the Theory of Chemical Combination
Edited by O. Theodor Benfey

These original papers by Friedrich Wöhler, Justus Liebig, Auguste Laurent, Alexander William Williamson, Edward Frankland, August Kekulé, Archibald Scott Couper, J. H. van't Hoff, and J. A. Le Bel illustrate the thinking of the chemists who developed the concept of valence. Theodor Benfey's introduction, epilogue, and running explanatory footnotes clarify the story and highlight significant turning points. Originally published in the Dover series Classics of Science (1964).

"More than a collection of classic masterpieces. Some will consider it to be a masterpiece itself."

– Journal of Chemical Education

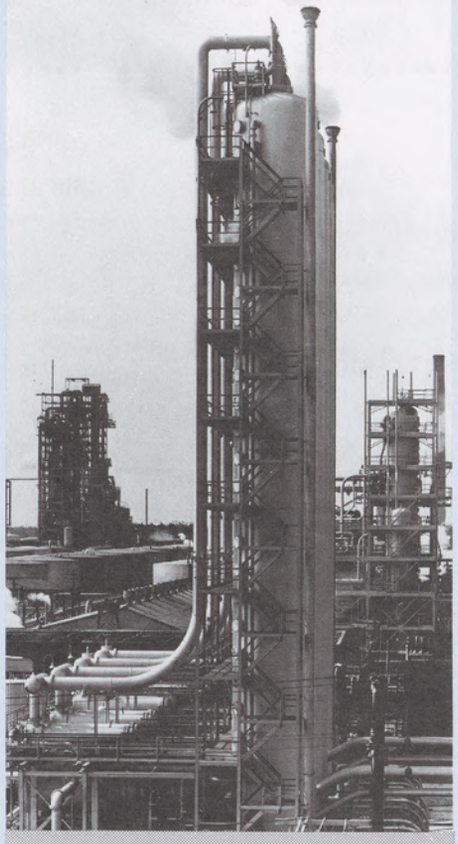
1981. xii + 192 pp, 9 illus. Index.
Cloth, 6 x 9, ISBN 0-89874-368-0
Special price: $20.00

Corporate History and the Chemical Industries: A Resource Guide
Edited by Jeffrey L. Sturchio

Three essays on the historiography of the chemical process industries, business archives, and oral history in the corporate setting provide the context for extensive annotated bibliographies on these three areas.

1985. ii + 54 pp, 12 illus. Bibliographies.
Paper, 5¾ x 8¾, ISBN 0-941901-02-5
$10.00

For more offerings and order blank see next page



A naphtha-fractioning tower at Exxon's Baytown, Texas petroleum refinery, 1949. Courtesy Exxon Corporation.

CHEMICAL HERITAGE FOUNDATION

A Guide To The Human Genome Project: Technologies, People, and Information
Compiled by Susan L. Speaker & M. Susan Lindee, with Elizabeth Hanson

This simple, concise introduction to the HGP for the general reader explores the origins of the genome project and reactions in the scientific community; important technologies and techniques; institutions connected with the HGP, including designated genome centers, important suppliers of resources, and corporations; systems of communication; and ethical, legal, and social issues.

A publication of the Beckman Center BIMOSI project. Available now.
40 pp, illus. Appendixes; glossary, bibliography, timeline.
Paper, 8½ x 11, ISBN 0-941901-10-6
$10.00

Polymer Pioneers: A Popular History of the Science and Technology of Large Molecules
Peter J. T. Morris

Polymer Pioneers gives an overview of the history of polymer science and technology through biographical sketches of twelve pioneers from Marcelin Berthelot and John Wesley Hyatt to Karl Ziegler and Giulio Natta. Time charts preceding each chapter summarize significant events.

1986. 88 pp, 80 illus. Bibliography.
Paper, 7 x 9, ISBN 0-941901-03-3
$10.00 ($8.00 each for 10 or more copies)

A Guide to Archives and Manuscript Collections in the History of Chemistry and Chemical Technology
Compiled by George Tselos & Colleen Wickey

This exhaustive inventory of research resources in American repositories answers the needs of scholars and other investigators of our chemical heritage.

1986. viii + 198 pp; 14 illus.
Geographical, name, and subject indexes.
Paper, 8½ x 11, ISBN 0-941901-05-x
$10.00

The following booklets are based on traveling exhibits and are profusely illustrated.
All are paperbound and contain bibliographies.
$5.00 each; $4.00 apiece for ten or more of each title.

Robert Burns Woodward and the Art of Organic Synthesis
Mary Ellen Bowden & Theodor Benfey

"This multifaceted portrait of an extraordinary human being, teacher, and consummate organic chemist should inspire more young persons to pursue scientific careers, provide chemists with deep insight into the creative mind of a 'legendary architect of molecules,' and enhance the public's understanding of chemistry and its research methods." – Journal of Chemical Education

1992. 48 pp, 8½ x 9½, ISBN 0-941901-08-4

Polymers & People: an informal history
Eric Elliot

This product of the CHF Polymer Project traces the history of polymer science and technology; the people who developed plastics, rubber, and fibers; the manufacture of these polymers; and the increasing role that polymers will play in our future.

1986. 32 pp, 8½ x 7¾, ISBN 0-941901-04-1

Structures of Life
Basil Achilladelis & Mary Ellen Bowden

Structures of Life describes how instrumentation has aided the merging of chemistry and biology in the new science of molecular biology.

1989. 36 pp, 8½ x 7½, ISBN 0-941901-07-6

Scaling Up: science, engineering, and the American chemical industry
John A. Heitmann & David J. Rhees

Scaling Up pays tribute to the engineers who transformed laboratory reactions into large-scale production facilities. The focus is on petroleum refining and penicillin production.

1984. 25 pp, 8½ x 7¾ , ISBN 0-941901-01-7

Joseph Priestley, Enlightened Chemist
David J. Rhees

The exhibit celebrating the 250th birthday of Joseph Priestley, on which this work is based, is now permanently at the Priestley House in Northumberland, PA.

1983. 34 pp, 5½ x 8½, ISBN 0-941901-00-9

Please send me the following books:

					QTY	PRICE
❑ Nobel Laureates in Chemistry, ed. James	Cl	0-8412-2459-5	$69.95		_____	_____
	Pb	0-8412-2690-3	$34.95		_____	_____
❑ Chemical Sciences in the Modern World, ed. Mauskopf	Cl	0-8122-3156-2	$39.95		_____	_____
❑ History of the International Chemical Industry, Aftalion	Cl	0-8122-8207-8	$46.95		_____	_____
	Pb	0-8122-1297-5	$15.95		_____	_____
❑ American Synthetic Rubber Research Program, Morris	Cl	0-8122-8205-1	$39.95		_____	_____
❑ From Vital Force to Structural Formulas, Benfey	Pb	0-941901-09-2	$15.00		_____	_____
❑ Classics in Theory of Chemical Combination, ed. Benfey	Cl	0-89874-368-0	$20.00		_____	_____
❑ Guide to the HGP, Speaker & Lindee	Pb	0-941901-10-6	$10.00		_____	_____
❑ Polymer Pioneers, Morris	Pb	0-941901-03-3	$10.00	($8.00 for 10+ copies)	_____	_____
❑ Guide to Archives, comp. Tselos & Wickey	Pb	0-941901-05-X	$10.00		_____	_____
❑ Corporate History, Sturchio	Pb	0-941901-02-5	$ 10.00		_____	_____
❑ Robert Burns Woodward, Bowden & Benfey	Pb	0-941901-08-4	$ 5.00	($4.00 for 10+ copies)	_____	_____
❑ Structures of Life, Achilladelis & Bowden	Pb	0-941901-07-6	$ 5.00	($4.00 for 10+ copies)	_____	_____
❑ Polymers & People, Elliot	Pb	0-941901-04-1	$ 5.00	($4.00 for 10+ copies)	_____	_____
❑ Scaling Up, Heitman & Rhees	Pb	0-941901-01-7	$ 5.00	($4.00 for 10+ copies)	_____	_____
❑ Joseph Priestley, Rhees	Pb	0-941901-00-9	$ 5.00	($4.00 for 10+ copies)	_____	_____

NAME _____

ADDRESS _____

_____

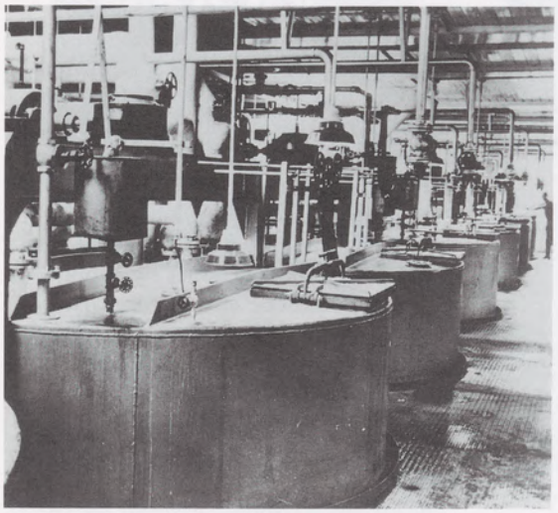
CITY STATE ZIP

All prices in U.S. dollars TOTAL _____

❑ Check enclosed ❑ Money order enclosed
Made out to the Chemical Heritage Foundation
All orders in North America postpaid;
for overseas orders add $5.00 per order

Send to: Chemical Heritage Foundation, Dept. 1120, 3401 Walnut Street, Suite 460B, Philadelphia, PA 19104-6228 USA

NEWS from the Donald F. & Mildred Topp Othmer Library of Chemical History



Modern bioprocess technology allowed the scaling up of production of penicillin, secreted by the aerobic organism Penicillium notatum. *Left: The deep tanks used in submerged fermentation at Pfizer in the 1940s. Courtesy Pfizer Inc.*

85

AIChE and Biotechnology

"BIOPROCESS" FERMENTATION TECHNOLOGY—the manufacture of chemical, pharmaceutical, and food products through the agency of microorganisms or enzymes—was the subject of one symposium at the 85th anniversary meeting of AIChE, held November 1993 in St. Louis. Entitled "Chemical Engineering and Biotechnology: Then and Now," the symposium was sponsored by the Institute's Chemical Engineering History group and organized by Elmer Gaden (University of Virginia).

The history of bioprocess technology is unique. The decade of the 1940s, especially its first half, saw a dramatic and virtually complete shift away from true (anaerobic) fermentation processes for the manufacture of structurally simple organics, for example, ethanol and butanol. Such materials were now easily and less expensively prepared through petrochemical technology. In their place stood an entirely new spectrum of processes that employed highly aerobic organisms—exhibiting voracious appetites for oxygen. The products formed were characteristically complex and labile molecules, generally in low mass concentration. Furthermore, their primary applications were pharmaceutical and nutritional, so quality standards were much more demanding than for the prior generation of "bulk" chemicals.

The symposium was opened by Robert Finn (Cornell), who traced the rapid immersion of engineers in the central concerns of, in his terms, "modern" bioprocess technology. Their contributions included defining and quantifying the mechanics of oxygen supply, design and scale-up of the the bioprocess proper, and separation and purification of products. They also made important contributions to aseptic processing techniques.

The next set of papers addressed bioprocess design and scale-up, first current practice (Peter Salmon, Merck), then prospective new approaches (Michael Schuler, Cornell). Schuler's central message is that the "reactor" of concern is the cell itself rather than the tank in which it is contained. Focusing on the cell allows one to deploy the full armament of molecular biology

Continued on page 20

Othmer Luncheon: Chemical Organizations Unite in Salute

90

Celebrating their common heritage and uniting in tribute to a remarkable leader they all share, five chemical organizations joined in planning the fifth annual Othmer Luncheon, to mark the ninetieth birthday of Donald F. Othmer on 11 May. The Chemists' Club was designated as the venue for a festive celebration, cosponsored by the American Chemical Society, the American Institute of Chemical Engineers, the Chemists' Club, the Othmer Library of the Chemical Heritage Foundation, and the Société de Chimie Industrielle.

The theme agreed on was "Dr. Othmer: This Is Your Life," with Patrick R. McCurdy, a chemical editor of great distinction, as chair of the event. Dr. Othmer was to be celebrated as educator, by Gerhardt Frohlich, one of Don's many distinguished students; as engineer, by Theodore O. Wentworth, his partner in engineering ventures for over half a century; as brother, by Mildred Othmer Peterson, his older sister and renowned globe-trotter; as member of the chemical community, by W. Alec Jordan, the founding editor of *Chemical Week*; as world traveler, by Henry G. McGrath, who like Don is a notable engineer much celebrated in foreign climes; and as friend, by John Shad, former chairman of the Securities and Exchange Commission. A videotape of the Othmer Library's new home at Independence National Historical Park was scheduled for its first showing. We join the celebrants in saluting Don Othmer's remarkable contributions to so many aspects of our chemical heritage, and wish him "many happy returns of the day."

17 May—In New York Once More

The Société de Chimie Industrielle gathers again on 17 May—to award its prestigious Palladium Medal to the chairman of the Dow Chemical Company, Frank P. Popoff.

ARCHIVES

Gifts to the Othmer Library

Group leaders in the Ames uranium production project. From the left: Harley A. Wilhelm, Adrian Daane, Amos Newton, Adolf Voigt, Wayne Keller, C. F. Gray, Frank Spedding, Robert Rundle, and James Warf. Courtesy Ames Laboratory.

Harley Wilhelm and the Ames Project

From 1942 to 1945 Iowa State College participated in classified research and development as part of the Manhattan Project. The Ames Project developed a process for making metallic uranium and scaled up its own industrial-type production plant. The project supplied two tons of the metal for the Chicago Pile experiment that demonstrated the first sustained nuclear chain reaction.

Steve Karsjen, Manager of Public Affairs and Information at the Ames Laboratory, which is operated by Iowa State University for the U.S. Department of Energy, gave the Othmer Library a gift documenting this project. The copy he sent of a Ph.D. dissertation by Carolyn Stilts Payne, "The Ames Project: Administering Classified Research as a Part of the Manhattan Project at Iowa State College, 1942–45" (Iowa State, 1992), gives an overview. The thesis looks at the science and technology activities of what was to become the Ames Laboratory, and examines how the administrative structure developed as it faced the challenges of security, contracting, and health issues. The laboratory adopted an academic management style in spite of being under the military Manhattan Engineering District. The university profited from what it learned at this time in its later relations with the federal government.

The genius whose chemical skills led to Iowa State's eminence was Harley A. Wilhelm born in Ellston, Iowa, in 1900. Before the Chicago Pile experiment, conducted on 2 December 1942 at Stagg Field, Arthur H. Compton was almost ready to use compounds of uranium—rather than the much-to-be-preferred metal—for lack of an efficient production method. Wilhelm then arrived from Ames with an eleven-pound ingot of uranium made by reduction of the tetrafluoride with calcium (later magnesium was used). This achievement led to the choice of Ames for the production of more than a thousand tons of uranium. The hundreds of workers in the factory had no idea what they were making, while the managers who knew kept their secret even from their spouses.

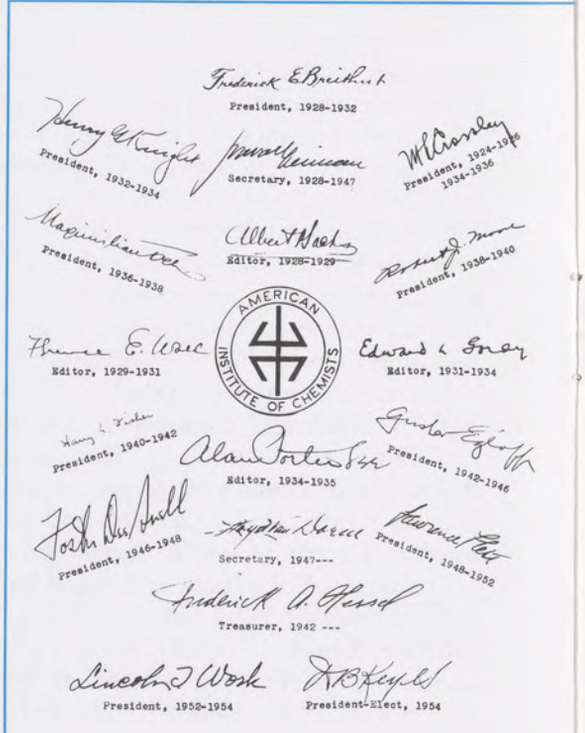
The gift also contained several newspaper clippings on Wilhelm and Ames, as well as a copy of Wilhelm's autobiographical notes (six single-spaced pages), which also detail his remarkable achievements in baseball. These are now part of the Othmer archives, thanks to Steve Karsjen's thoughtfulness.

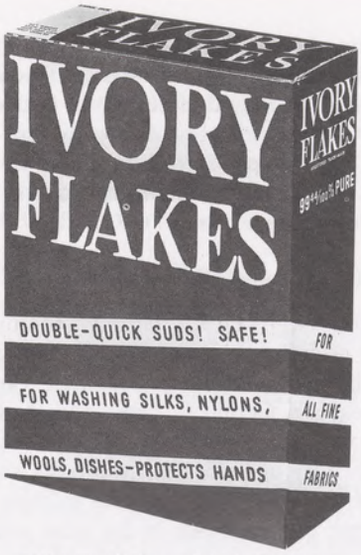
When 99$^{44}/_{100}$% Pure Isn't Good Enough

When two University of Washington alumni met at Procter & Gamble in the early days of World War II, there was more to talk about than memories of their college days. Waldo Semon, the inventor of polyvinyl chloride and bubble gum, was visiting Victor Mills, who has been described as the most innovative technologist in the 134-year history of P&G.

At B. F. Goodrich, Semon was one of the key figures in the wartime effort to develop a synthetic rubber by copolymerizing butadiene and styrene. The process also involved a catalyst, a modifier, and soap as an emulsifier. Semon described to Mills the problem they were having with catalyst poisoning and enumerated the possible sources of that difficulty.

According to Mills, "it suddenly occurred to me that Ivory Soap wasn't [in fact] pure. We added a very small amount of perfume to cover up the soapy odor." He subsequently had the factory make up a special batch of Ivory Flakes sans perfume, and it worked fine. All through the war Procter & Gamble continued to ship what were called "special Ivory Flakes" that were crucial to the spectacular success of the





A box of Ivory Flakes—99 44/100% pure—circa World War II. The Procter & Gamble Company. Reproduced by permission.

synthetic rubber program. Mills confesses that "it wasn't until a long time afterwards that I told Waldo what it was, that I had simply taken the perfume out."

JAMES J. BOHNING

Based on oral history interviews of Semon and Mills conducted in 1992 and 1993 by Bruce A. Finlayson of the Chemical Engineering Department, University of Washington, who kindly provided transcripts and tapes for the Othmer Library collection.

From Baseball Statistics to G. N. Lewis (1875–1946)

Harold R. Paretchan, an analytical baseball statistician and researcher who lives in Weymouth, Massachusetts, persuaded the state's governor, William F. Weld, to declare 23 October 1993 Gilbert Newton Lewis Day to honor Lewis's birth in Weymouth on 23 October 1875, and his many achievements. Senator Edward M. Kennedy spoke on Lewis in the U.S. Senate, and his words were recorded in the *Congressional Record*. Paretchan has sent CHF the complete record of how he managed to win this recognition for Lewis, including copies of relevant letters (from Glenn Seaborg, Linus Pauling, Henry Taube, Daniel Koshland, Lewis family members, and government officials among others), newspaper and journal articles, and biographical information; lists of Lewis's publications and of his 290 Ph.D. students; Governor Weld's proclamation; and a *C&EN* article telling the Paretchan story (1 Nov. 1993, pp. 25–27). Included also was the famous preface Lewis and Merle Randall wrote in their classic 1923 *Thermodynamics* likening the creation of thermodynamic theory to the construction of a cathedral:

"There are ancient cathedrals which, apart from their consecrated purpose, inspire solemnity and awe. . . . The labor of generations of architects and artisans has been forgotten, the scaffolding erected for their toil has long since been removed, their mistakes have been erased, or have become hidden by the dust of centuries. . . . But sometimes we enter such an edifice that is still partly under construction; then the sound of hammers, . . . enable[s] us to realize that these great structures are but the result of giving to ordinary human effort a direction and a purpose."

"Science has its cathedrals, built by the efforts of a few architects and of many workers. In these loftier monuments of scientific thought a tradition has arisen whereby the friendly usages of colloquial speech give way to a certain severity and formality. While this may sometimes promote precise thinking, it more often results in the intimidation of the neophyte. Therefore we have attempted, while conducting the reader through the classic edifice of thermodynamics, into the workshops where construction is now in progress, to temper the customary severity of the science in so far as is compatible with clarity of thought."

Paretchan's next goal is a U.S. postage stamp honoring Lewis.

GIFTS *continued on next page*

Left: The AIC in 1954. Gustav Egloff, Lawrence Flett, Donald B. Keyes, and Foster Dee Snell are among the notables.

AIC Archives come to CHF

The American Institute of Chemists was founded in 1923. Its aim is to improve public recognition of the chemical profession, and to establish and maintain standards of proficiency. AIC is the most recent of CHF's affiliates (*Chemical Heritage* 10:2, Summer 1993, p. 1), and has now deposited its archives with CHF. A finding aid for the archives was prepared for CHF by Carmen Lee, former librarian for Joseph Needham's East Asian History of Science Library in Cambridge, England. An impressive set of photographs was donated with the archives.

Right: Emmett B. Carmichael of the Medical College of Alabama, AIC president for 1967–69, welcomes Pauline Newman as an Honorary AIC Fellow. Newman, an industrial chemist and lawyer, became director of FMC Corporation's patent and licensing department. She is now a federal judge on the Court of Appeals in Washington, D.C. Between these posts she was chair of the ACS Finance Committee and a science adviser to UNESCO.

Left: On 7 January 1960 Florence E. Wall, the only woman among AIC's founding members, is declared an honorary member by then AIC president Wayne E. Kuhn of the Texaco Company. Having successfully survived her first employment—with the Radium Luminous Materials Corporation of Orange, New Jersey—she became a pioneer in the science of cosmetology.

Other Gifts to CHF

Clayton Aniline, Dreyfus, Weizmann, and Perkin

Colin A. Russell and Peter J. T. Morris, in *Archives of the British Chemical Industry 1750–1914: A Handlist* (Faringdon, Oxon.: British Society for the History of Science, 1988), mention that the Clayton Aniline Company near Manchester (now part of Ciba-Geigy) has records of the company's founding by Charles Dreyfus and of its early years, but that these are not accessible. Katie Heywood of Manchester, a Dreyfus relative, has now passed on to us copies recently given her by the Clayton Aniline librarian of four letters that William H. Perkin, Jr., then at Owens College, wrote to Dreyfus in 1907. Perkin asked his colleague Chaim Weizmann, the future president of Israel, to work with Dreyfus on a synthesis of camphor. The letters relate their attempts to sell the resulting patents to the French Société de Camphre or to Schering & Co. of Germany. The latter had appointed the Finnish chemist Ossian Aschan to head their camphor laboratories (see this journal, 9:2/4:2, pp. B-4–5 on Weizmann, O-6 on Ossian).

Peter Debye Measures Molecules

On his last trip to Europe, in 1962, Peter J. W. Debye (1884–1966; Nobel Prize, 1936) gave a public lecture, "The Measuring of Molecules," in his native town of Maastricht, Holland. Mansel Davies of the chemistry department of University College of Wales, Aberystwyth, sent us a 33-rpm recording of the lecture. Debye's preliminary comments are in Dutch; his lecture is in German.

Nuclear Pioneers on Videotape

In 1991 Virginia Tech gathered the nuclear scientists Sigvard Eklund, Bertrand Goldschmidt, Robert E. Marshak, Glenn T. Seaborg, Gerald F. Tape, and Herbert F. York to discuss four topics covering the history of 1945–1965: weapons and the arms race; civilian versus military control; peaceful uses of the atom and basic research; and international per-

Found in the Othmer Library V: Justus von Liebig

To handle the unique one-volume *Complete Works of Liebig* published in Philadelphia in the 1850s is to be faced immediately by a series of bibliographical puzzles. Why is there no date on the principal title page? Why do these title pages vary in different copies? Why is no one acknowledged as responsible for compiling the work? Why do the five (sometimes only three) reprinted books each have their own separate title pages? And finally (and here the penny begins to drop), why are all of Liebig's original prefaces (whose dates are known accurately from their original European or American printings) sometimes redated either "August 1850" or "August 1852"?

The answers to these puzzles lie in the identity of the printer and publisher of the volume, Theophilus B. Peterson of 302 Chestnut Street, Philadelphia. Of Anglo-Swedish stock, he was born in Philadelphia in 1823 and is described by John Tebbel as "the preeminent publisher of sensational fiction and cheap reprints."[1] Beginning as an errand boy at thirteen, Peterson went through a succession of jobs before setting up as a bookseller in 1845. He soon concluded that he could make more money if he personally printed, or stereotyped, in bulk what he sold. Peterson's profits came mainly from printing very cheap editions of popular fiction, including the works of Charles Dickens. It says something of the perceived popularity and significance of Liebig's books for American farmers, doctors, and teachers that Peterson issued reprints of Liebig's *Agricultural Chemistry* (1840), *Animal Chemistry* (1842), and *Chemical Letters* (1843) between 1845 and 1850. Then, in the next decade, he offered the further bargain of the *Collected Works* in one volume for $1.50, reprinting the original three volumes together with *The Motion of Juices* (1848) and the didactic *Chemistry and Physics in Relation to Physiology* (1846). As stocks were exhausted, he inserted a fresh and slightly different principal title page. Inspection of copies in the Othmer and University of Pennsylvania libraries suggests that editions of *The Collected Works* were issued in 1850 (lacking *Chemical Letters* and *Chemistry and Physics*), 1852, and 1856, with possibly a final impression in 1858. That Liebig's own views had altered considerably in successive European editions of *Agricultural Chemistry*, *Animal Chemistry*, and *Chemical Letters* was of no concern to Peterson. But any historian resorting to the undoubtedly useful *Collected Works* should be aware that each text is in fact a stereotyped reprint of a first European or American printing. The set also lacks Liebig's important *Chemistry of Food* (1847).

Sadly, Peterson, the owner of "The Cheapest Book House in the World," overextended his business and went bankrupt in 1880. He survived another decade before dying on 30 December 1890.

WILLIAM H. BROCK
University of Leicester

1. John Tebbel, *A History of Book Publishing in the United States*, 4 vols. (New York: R. R. Bowker, 1972), vol. 1, pp. 245–246.

The Liebig family. Courtesy the Liebig Museum, Giessen.

spectives. Copies of the videotapes of these sessions, plus a two-hour group interview that included Jerry Bishop of the *Wall Street Journal* as one of the questioners, have been deposited at a select group of repositories, among them CHF.

Nobel in the Harz Mines

Jean Bartz Scurlock of Kansas City, Missouri, has sent the Othmer Library background information on Nobel's development of dynamite, including a thirty-eight-page illustrated booklet, *The Regional Museum of Clausthal-Zellerfeld with Its Inspection Mine.* It reports that Bergrat Schell, inspector of mines in 1865, had paper tubes filled with sand soaked with the highly unstable liquid nitroglycerine. The method put an end to the accidents that frequently occurred with the liquid alone. In 1866 Alfred Nobel came to the Harz mountain town of Clausthal to attend experiments using this procedure. He then introduced kieselguhr as an alternative adsorbent, leading to dynamite.

Spain and Chemical History

Since chemical history articles in Spanish are not widely accessible, Juan Antonio Perez-Bustamente, an analytical chemist and chemical historian at the University of Cadiz, sent us his recent historical publications—articles on Roger Bacon, Boyle, Scheele, Faraday, the naming of the electron, and the holistic conception of alchemy, as well as a 32-page history of analytical chemistry. Included also was his "Highlights of Spanish Chemistry at the Time of the Chemical Revolution of the 18th Century" (in English; *Fresenius Journal of Chemistry* 337 (1990), 225–228.)

Chemistry in the Rockefeller Archives

The Rockefeller Archive Center houses some fifty million pages of documents, over 250,000 photographs, and more than 3,500 reels of film. It is the repository for the papers of the Rockefeller family and its various philanthropic activities. In recent years the Archive Center has also acquired the records of non-Rockefeller philanthropic organizations. Within this constellation of collections, the Archive Center includes significant holdings in various aspects of the history of chemistry.

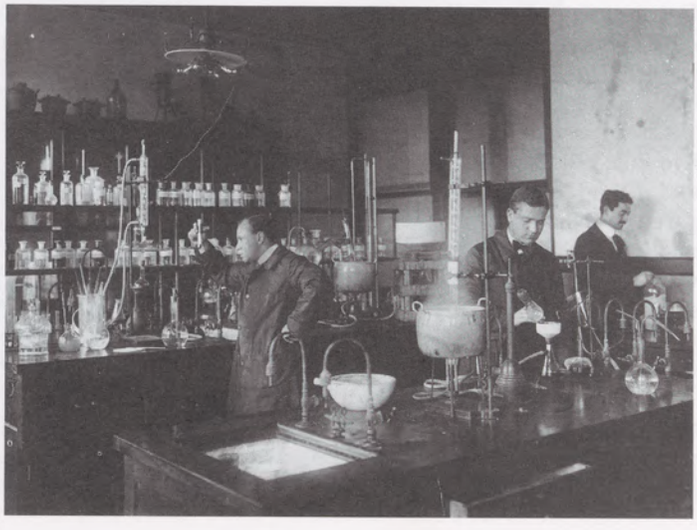
One of the more valuable sources for history of chemistry is the archives of the Rockefeller University, founded in 1901 as the Rockefeller Institute for Medical Research (RIMR). These files—approximately 3,000 cubic feet—encompass the university's administrative, financial, and personnel records and document the scientific research and careers of many of America's leading twentieth-century scientific investigators. The first director, Simon Flexner, committed the RIMR to chemical research in 1905, when he recruited P. A. T. Levene, a promising thirty-six-year-old chemist who became a charter member of the Society of Biological Chemistry, founded in 1906. The RIMR published the society's journal, *The Journal of Biological Chemistry*, for a decade, starting in 1914.

Other RIMR members include Jacques Loeb, there from 1910 to 1924; Duncan MacInnes, a pioneer in electrochemistry, who came in 1926; and Lyman Craig, Walter Jacobs, William Stein, and Stanford Moore. During Craig's years at the RIMR (1933–1974), he developed a countercurrent distribution technique used for the separation and distribution of biologically significant compounds. Jacobs, who had originally worked in Levene's laboratory on the chemistry of nucleic acids, later focused his attention on chemical pharmacology. Stein and Moore were awarded a Nobel Prize in 1972 for their investigations into the chemical structure and activities of ribonuclease after World War II.

The Rockefeller University Archives also holds the papers of Paul Ehrlich, a pioneering investigator in chemotherapy and immunology. Although Ehrlich was not directly affiliated with any Rockefeller institution, the Rockefeller family recognized the significance of his scientific accomplishments and offered financial support. The Ehrlich collection includes copybooks, correspondence, notebooks, and memorabilia.

Holdings in the history of chemistry outside the Rockefeller University Archives are located mainly in the voluminous Rockefeller Foundation Archives (1910–). The Rockefeller Foundation (RF) was established in 1913 by John D. Rockefeller, Sr., "to promote the well-being of mankind throughout the world"; historically the RF has supported the medical, natural, and social sciences and the humanities. Record Groups 1 (Projects) and 3 (Program and Policy) document the grant-making process and the evolution of RF programs over a seventy-year period.

Most relevant to historians of chemistry are files from the Divisions of Natural Sciences and Medical Sciences. The former was established in 1928, although fellowships in chemistry and physics had been made available since 1919 through the National Research Council. Under the direction (1932–1951) of Warren Weaver, the Natural Sciences division concentrated on experimental biology and especially on the application of mathematics, physics, and chemistry to biological problems. Foundation grants in this period, notably to Linus Pauling at the California Institute of Technology, spurred the development of biochemistry and biophysics in the United States and Europe. Physiology, genetics, and embryology research also expanded under Weaver's direction. In 1951 the division was enlarged and renamed the Division of Natural Sciences



The laboratory of P. A. T. Levene at the Rockefeller Institute ca. 1910. From the left: Walter A. Jacobs, Donald D. Van Slyke, and Gustave M. Meyer. Courtesy Rockefeller Archive Center.

Continued on next page

Paul Ehrlich surrounded by his family, ca. 1906. From the left, standing: Max Pinkus (wife's brother-in-law); Marianne Landau (daughter); Edmund Landau (son-in-law), a Göttingen mathematician; Mrs. Pinkus (wife's sister); Ernst Schwerin (son-in-law). Seated: Stephanie Schwerin (daughter); Klaus Pinkus (nephew); Paul Ehrlich; his wife, Hedwig. In front: Hans Pinkus (nephew). Courtesy Bernhard Witkop.

and Agriculture, reflecting the shift towards agricultural research that began in 1943, when a program in scientific agriculture was established in Mexico. Records document field office operations in detail as well as the collaboration between RF and local scientists in agricultural chemistry and soil science.

The Foundation gave direct assistance to American medical schools from 1902 and to medical schools outside the United States from 1919. In 1929 the Division of Medical Education changed its focus from teaching to research and was renamed the Division of Medical Sciences. Alan Gregg assumed the post of director in 1931. Over the next twenty years Gregg built up programs in psychiatry and related fields. His view of mental illness as a disease amenable to clinical investigation encouraged new research in neurology, neuroanatomy, neurobiology, pharmacology, human genetics, and endocrinology. Grants also supported work in chemistry, physiological chemistry, biochemistry, and medical chemistry. Many recipients from the mid 1930s through the postwar years were scholars fleeing the upheaval in Europe. When the Foundation was reorganized in 1951, the Division of Medical Sciences merged with the International Health Division to become the Division of Medicine and Public Health. In the 1970s biomedical, health, and population sciences became the foci of Rockefeller philanthropy in the medical field.

Researchers may also consult related materials in the archives of the General Education Board (est. 1902), the International Education Board (est. 1923), and the Commonwealth Fund (est. 1918), all held at the Rockefeller Archive Center. For more information about the collections, please contact the Rockefeller Archive Center, 15 Dayton Avenue, North Tarrytown, NY 10591-1598.

LEE HILTZIK
VALERIE S. KOMAR
Rockefeller Archive Center

Albert W. Smith's Diaries and Mustard Gas Research

A few weeks after the United States entered World War I (on 17 April 1917) the Germans introduced the most effective of the toxic gases they developed in that war: mustard gas, or di(chlorethyl) sulfide. In their first attack using it, at Ypres on 12 July 1917, they blasted a five-mile hole in the Canadian lines, and if the German forces had been prepared to follow up on this success, they might have changed the course of the war. They were not, but "mustard" was soon dubbed "king of the poison gases," and it became the most-used German gas weapon.

The Allied powers realized they had to respond to this awful new threat with speed and urgency. In the United States the War Department moved swiftly to begin creating its own gas weapons and to recruit some of the nation's top chemists and chemical engineers for this effort. Within a few months, for example, William L. Walker of MIT, father of chemical engineering, was a colonel; William McPherson of Ohio State University was a captain.

Another recruit was Albert W. Smith, head of the chemistry department at the Case School in Cleveland, now part of Case Western Reserve University. Smith was called urgently to Washington to meet with George Burrell, assistant director of the Bureau of Mines, one of the principal recruiters of the chemical contingent.

Unfortunately, few documents of this episode in U.S. chemical history have survived. So two diaries kept by Smith, recently discovered in the Case archives, shed considerable light on the events preceding and associated with the formal establishment, in July 1918, of the Chemical Warfare Service (CWS). Smith, the first American to devise a successful way to manufacture mustard gas, did not keep his correspondence on the subject (presumably having turned it over to the military), although his other papers are scrupulously maintained in the Case archives.

Burrell proposed that Smith devote two-thirds of his time to military problems for the duration of the war, at a salary of $2,500 per annum. At first he worked on antifogging agents for the eyepieces of the gas masks then being hastily developed, and on gas adsorbents for the mask; the United States had done no work at all up to this point on gas masks. Later he successfully worked on tear gases, which were manufactured at the Dow Chemical Company in Midland, Michigan. Smith had been a fellow student of Herbert Dow's at Case and was a member of the Dow board of directors as well as a close friend of Dow's. Tear gases were shipped from Midland to army camps around the nation to help troops train with gas masks before they left for the front.

Early in 1918 the War Department inaugurated a crash program to produce mustard, and Smith and Herbert Dow were summoned to meet with Burrell (now a colonel), who asked Smith to drop everything else and concentrate on a process for making the gas. Several other top scientists were also asked to take on this challenge. Dow offered his

lab and plant facilities at Midland for the effort, and Smith then holed up in a lab at Midland to work on the problem. His eventual solution called for reacting ethylene and sulfur chloride in a large rotating drum, in the presence of a catalyst. Within a few weeks he had set up a pilot plant at Midland, and on April 23 he made his first mustard gas. This small plant was immediately declared a secret U.S. war installation, and it became the main (and for some time the only) source of mustard gas for U.S. forces, although they never actually used it in the war. Nevertheless, President Woodrow Wilson was highly pleased to let the Germans know that U.S. forces were in a position to use it. Later in the war production was switched to Edgewood Arsenal, home of the new CWS.

The two Smith diaries, one devoted to his general work on toxic gas and the other to his work on mustard gas, lay unrecognized for almost seventy-five years because of the codes he used. His references to mustard gas only use the military code for it, "G-34"; he also refers to other toxic gases by their military codes—"S-2," "Y2," "Y11," and the like.

E. N. BRANDT
Post Street Archives, Midland, Michigan

Below: Students working in the cyanide plant in the Mining Building of Case School of Applied Science. Albert W. Smith is second from the left. Courtesy Case Western Reserve University Archives.

PUBLICATIONS

(Lone) Star in Chemical Engineering

Howard F. Rase; William A. Cunningham. *Chemical Engineering at the University of Texas, 1910–1990.* Edited by **Cheryl M. Rawlings.** Austin: Department of Chemical Engineering, College of Engineering, University of Texas at Austin, 1990. xiv + 282 pp. $20.00.

In the past few decades the Department of Chemical Engineering at the University of Texas (UT) has become one of the more important such departments in the United States. In 1985 it ranked third in the country among chemical engineering departments in research funding, and in the late 1980s it was in the top five in Ph.D. production.

According to Rase and Cunningham, the authors of this volume, the department's founding father—and for many years its only faculty member—was Eugene P. Schoch. Like many early chemical engineers, Schoch was initially a chemist, with a Ph.D. from the University of Chicago (1902). In the 1910s Schoch, then in the Department of Chemistry at Texas, began to shift his attention from theoretical chemistry to industrial chemistry, hoping to promote the use of the state's raw materials and thus aid its economy. When German chemicals were cut off from the U.S. market during World War I, Schoch persuaded his fellow chemists and the head of the Engineering Department at UT to approve a formal degree in chemical engineering. The new degree program accepted its first students in 1916–1917.

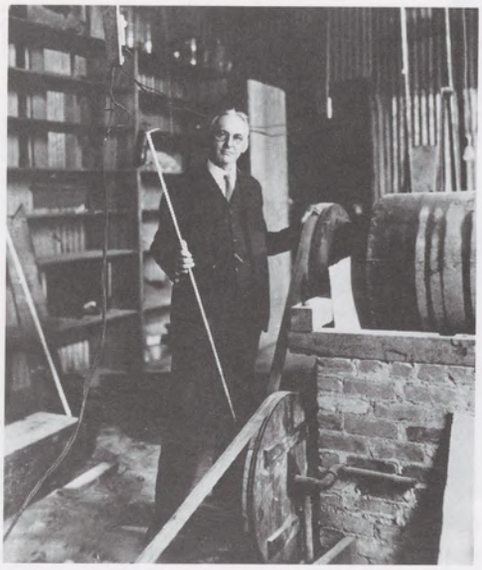
From that time until 1935 Schoch was the only full-time faculty member in Chemical Engineering. Only in the mid 1930s, when companies like Dow and Union Carbide began to plan petrochemical facilities for Texas, did the department begin to grow. In 1935 and 1936 Schoch was joined by W. A. (Bill) Cunningham and John Griswold.

The Chemical Engineering Department nonetheless remained attached administratively to the Department of Chemistry. There were positive as well as negative aspects to this link. In the 1930s and 1940s engineering students did not normally pursue graduate studies; chemistry students did. Affiliation with Chemistry enabled Chemical Engineering to establish a substantial graduate program much earlier than would otherwise have been possible. It also provided the department with a strong research orientation.

One of Schoch's goals was to secure AIChE accreditation for his department, a task finally accomplished in 1943, shortly after the department separated from Chemistry and moved to the College of Engineering. As Texas's petrochemical industry expanded at an explosive rate during the 1940s and the 1950s, so did the department. Quality faculty were added—among them future National Academy of Engineering members John J. McKetta, Jr. (in 1946), and Robert S. Schechter (in 1956)—and student numbers grew significantly.

From the 1920s on, the department also benefited from UT's Permanent University Fund, an endowment based on revenues from public lands provided the university at its founding by the state legislature. Spurred by this fund, the growing importance of the petrochemical industry to Texas's economy, and growing industrial support, the department grew steadily, especially its graduate and research programs. On their strength the department even prospered in the late 1980s, when undergraduate chemical engineering enrollments dropped dramatically all over the country; UT on the contrary added

Continued on next page



Left: Eugene P. Schoch worked in his "Tin Shack" laboratory during the 1920s. Courtesy the Schoch family and the University of Texas.

Right: Students Jim Upchurch (lower) and Al Severin worked on the two-story distillation column in the Unit Operations Laboratory (Room 101) in 1947. Courtesy University of Texas Department of Chemical Engineering Archives.

PUBLICATIONS—*continued*

five strong new faculty members.

Rase and Cunningham's account is organized chronologically by decade, and each chapter follows a similar format. The authors first provide a general historical context for the decade, review the growth of Texas industries employing chemical engineers, and outline developments at the university as a whole. They then turn to Chemical Engineering specifically, reviewing new faculty, curricular changes, graduate research, and new equipment and buildings. Next follows a general description of student life, an account of varsity athletics, and short sketches of the careers of departmental graduates. Each chapter ends with biographical sketches of every faculty member who joined the staff during that decade.

The book concludes with a chapter of miscellaneous anecdotes (organized by decade) and multiple appendixes. These last provide a year-by-year account of degrees granted and "distinguished graduates," plus lists of graduates in the teaching profession, books written or edited by faculty, alumni club officers and class secretaries, endowed positions, and a nonacademic staff history.

This work's comprehensiveness is clearly one of its greatest strengths. Rase and Cunningham have provided future scholars with easy access to a mass of data relating to such diverse and important topics as curricular change, faculty backgrounds, and student placement. Another strength is the use of summaries of the development of Texas industry and the evolution of the University of Texas to place the department's history in context. Finally, the text is both well organized and well written.

The book, however, shares some of the generic weaknesses of departmental histories. Much of the mass of information it contains is of interest only to departmental alumni. While generous with praise, the authors do not discuss any errors or mistakes the department made. Moreover, they do not provide enough comparison with similar departments at other schools. At times they account for the trees, but not the forest: In discussing curricular revisions, for example, they present the details of changes made during specific decades, but fail to give the reader a broader view across several decades and to put these changes into the context of national trends in engineering education. Finally, I question the authors' decision to include information on every building constructed on the campus, some of the material on general student life, and the sections on varsity athletics.

Because the primary intended audience for this book is undoubtedly UT alumni, some of these "shortcomings" are understandable and justifiable. By preparing a thorough, well-organized, and well-written account of the evolution of what has become an important American chemical engineering department, Rase and Cunningham have furnished a significant resource to those studying the history of chemical engineering education in America.

TERRY S. REYNOLDS
Michigan Technological University

One Chemical Marriage

Gerit von Leitner. *Der Fall Clara Immerwahr: Leben für eine humane Wissenschaft.* Munich: Verlag C. H. Beck, 1993. 232 pp. DM 39.80.

This book recounts the life and tragic death of one of the first German women to receive a doctorate in chemistry from a German university. The case puts into perspective the almost overwhelming obstacles and social pressures that faced the first pioneering generation of women chemists in a country whose universities first admitted women as regular students only nine decades ago. Some women overcame these obstacles and went on to become productive scientists, but all had to make difficult choices, usually between a career and a marriage. Clara Immerwahr's choice for the latter in 1901 was not unreasonable in view of the dismal career prospects and rock-bottom salaries that then confronted women in academe or industry—especially given the brilliance and promising career of her husband, the physical chemist Fritz Haber—but in the end she paid a terrible price.

Following the birth of a child, Clara gradually gave up her efforts to continue to do scientific work within the framework of a middle-class marriage. During the next decade Fritz's career soared with the ammonia synthesis that made him famous, made him director of the Kaiser Wilhelm research institute for physical chemistry in Berlin-Dahlem, and ultimately won him a Nobel Prize in 1918. But Clara, like many creative women of her time forced by marriage

into dependent roles and intellectual inactivity, became increasingly depressed and alienated from her husband. When war came in 1914, Haber patriotically militarized his institute, introducing poisonous chlorine gas as an alternative weapon in the spring of 1915. This was evidently the last straw for Clara, who shot herself with her husband's service revolver just before he left to supervise gas attacks on the Russian front. Haber nevertheless carried on as chemical warfare chief to the end of the war, brooking no criticism. He never publicly acknowledged the suicide, the major newspapers hushed it up, and any documents Clara might have left concerning it disappeared.

Clara Immerwahr's life and death have recently been rescued from obscurity through scholarly and popular interest, including a German radio program on her life, and now this interesting biography. The scarcity of the surviving documentary evidence makes Leitner's task very difficult, but she has not made the task of evaluating her conclusions easier by her reluctance to cite all sources fully and specifically or to indicate when she is making conjectures or inferences. When she can be checked, however, she is accurate, as with Clara's revealing letters to her mentor Richard Abegg, himself a victim of a tragic accident in 1910. Aside from Immerwahr's own tragic end, the social and political issues implied in her case retain great contemporary interest. While German women scientists certainly face fewer obstacles than in her day, they are still far from enjoying true equality of opportunity with men.

JEFFREY A. JOHNSON
Villanova University

Kolbe and the (R)evolution in Organic Chemistry

Alan J. Rocke. *The Quiet Revolution: Hermann Kolbe and the Science of Organic Chemistry.* Berkeley: University of California Press, 1993. xv + 501 pp. $50.00.

This lengthy and complex study simultaneously pursues three objectives: a biography of Hermann Kolbe, one of the most important nineteenth century organic chemists; a detailed survey of mid-nineteenth-century organic chemistry; and the thesis that a "quiet revolution" occurred during the 1850s that

Adolf Wilhelm Hermann Kolbe (1818–1884) was a towering figure in nineteenth-century organic chemistry. He is seen here in a pen-and-ink drawing made by Ferdinand Justi in 1880, from a photograph of about 1860. Courtesy of the Erbengemeinschaft Justi, Bildarchiv Foto Marburg.

transformed chemistry from a premodern to an early modern phase of theoretical, academic, and industrial development.

The first of these occupies only slightly more than half the book and serves as a backdrop for the other two. Kolbe himself emerges as an ambiguous figure. A superb lecturer and skilled experimentalist, he pioneered research into reactions involving diacids and syntheses of secondary and tertiary alcohols. His research laboratory in Leipzig was the largest in Germany, and it later brought him control of the venerable *Journal für praktische Chemie* as a platform for his views. Yet he squandered his resources, increasingly pursuing sterile byways and isolating himself by stubborn adherence to outmoded concepts and vitriolic assaults upon professional rivals.

Rocke follows his protagonist's quixotic career as a latter-day disciple of J. J. Berzelius's electrochemical dualism in the guise of radical theory, tilting against the windmills of first the type theory of the French school and then the structural chemistry of his *bête noir*, August Kekulé. As for the supposed dramatic shift toward modern valence theory and the "atomicity of the elements" within compounds, Rocke argues that it resulted not from the renowned 1860 Karlsruhe conference, but from theoretical and experimental advances made in organic chemistry during the preceding decade, reflected in the changing fortunes of these competing theories. Rocke's comprehensive scope also considers such factors as generational divisions between different schools of theorists; the transformation of chemistry laboratories in German universities from small technical training facilities for artisans to major research institutions for promoting both science and industry; and the relative importance in Germany of government policy, economic conditions, and social divisions, including Kolbe's own virulent anti-Catholic and anti-Semitic bigotry.

While thus not "internalist" in his approach, Rocke clearly sees ideas as the primary causal and explanatory agents. He concludes with a discussion of recent historiographic arguments and a defense of his approach against the more extreme social constructionists.

JAMES ALTENA
Edelstein International Student

Japanese Chemistry, Then and Now—in English

Togo Tsukahara. *Affinity and Shinwa Ryoku: Introduction of Western Chemical Concepts in Early Nineteenth-Century Japan.* Amsterdam: J. C. Gieben, 1993. 333 pp.

Ryoji Noyori, editor. *Organic Synthesis in Japan, Past, Present, and Future. In Commemoration of the 50th Anniversary of the Society of Synthetic Organic Chemistry, Japan.* Tokyo: Tokyo Kagaku Dozin. 1992. 565 pp.

That English has become the international language is amply confirmed by these two books in English, written by Japanese. The first is a doctoral dissertation at the University of Leiden, the second a festschrift designed to inform the world community about the achievements and particular emphases of Japanese synthetic organic chemistry.

Tsukahara looks at the beginning of Western chemistry in his country, with the publication of Udagawa Yoan's *Seimi Kaiso* (The foundation of chemistry; 1837–47); he notes the book's central theme of affinity and the interaction between this concept and somewhat related ideas in Shintoism, Buddhism,

Continued on next page

PUBLICATIONS—*continued*

and Confucianism. Western chemistry was by no means adopted without cultural adaptation.

Japanese synthetic organic chemistry, too, can be distinguished from such work elsewhere. The initial seven chapters of the Noyori book survey the development of the field in Japan, including its role in the chemical and pharmaceutical industries. At first synthetic organic chemists concentrated primarily on natural products. Their professional organization was founded in 1942 by academic and industrial leaders. The historical chapters are followed by papers on the current state of the field, written by many of its leading practitioners. The publisher, Tokyo Kagaku Dozin, also puts out *Gendai Kagaku* (Modern chemistry) the highly successful monthly magazine for Japanese chemistry students, much like *Scientific American*, but focused on the chemical sciences.

Books to Note

Charles Tanford; Jacqueline Reynolds. *The Scientific Traveler: A Guide to the People, Places, and Institutions of Europe.* New York: John Wiley & Sons, Inc., 1992. 335 pp. $16.95.

The authors, emeritus professors at Duke University known for their chemical and biological research, take the scientific traveler throughout Europe to the 140-some sites where more than 250 men and women made their mark on the sciences. From Aristotle and Avogadro to Wöhler and Zeeman, from Athens to Giessen, St. Petersburg, and Zurich, the reader is given details on travel and visiting the sites, as well as background mini-essays on such topics as "Islamic Science," "Electricity on the Move," "The Rise of German Chemistry," and "Atomic Power Is Unleashed." The last, on Otto Hahn and Lise Meitner, comments on how Meitner has only belatedly been recognized in commemorative sites.

Gerald L. Geison; Frederic L. Holmes, editors. *Research Schools: Historical Reappraisals.* Chicago: Chicago University Press, 1993. 280 pp. $39 (cloth); $25 (paper).

This eighth and newest volume of *Osiris*, with Arnold Thackray as series editor, contains interpretative essays by John Servos, Kathryn M. Olesko, and Mary Jo Nye, and papers focused on chemistry by Alan J. Rocke (on Hermann Kolbe's Marburg and Leipzig Institutes) and Jack Morrell (on W. H. Perkin, Jr., at Manchester and Oxford).

W. V. Metanomski. *50 Years of Chemical Information in the American Chemical Society, 1943–1993.* Washington D.C.: American Chemical Society, Division of Chemical Information, 1993. 124 pp.

This illustrated divisional history tells the story of the ACS division known as the Chemical Literature Group (1943–1948), the Division of Chemical Literature (1949–1975), and (since 1975) the Division of Chemical Information. As might be expected from information specialists, the book is thoroughly documented and indexed, with helpful tables of officers, symposia, books, and winners of the Herman Skolnik Award for advances in chemical information science. Skolnik, founding editor of the *Journal of Chemical Information and Computer Sciences*, was the first recipient of that award.

Deutsches Museum. *Wissenschaftliches Jahrbuch 1992–93.* Munich: R. Oldenbourg Verlag, 1993. 332 pp. DM 24.

The Deutsches Museum's annual *Wissenschaftliches Jahrbuch* is a collection of scholarly papers in German with English abstracts. Its 1992–93 volume contains four articles on chemical science: Brigitte Hoppe, "Development of Experimental Methodology in Research on Gas Exchange and Photosynthesis"; Paul R. Jones, "Justus von Liebig and Baking Powder" (on Liebig and Eben Horsford); Viktor A. Kritsman, "The History of Chemical Kinetics: New Views"; and Elisabeth Christine Vaupel, "The Early History of Aluminium: Achievements of Friedrich Wöhler and Henri Sainte-Deville in Light of Newly Discovered Correspondence and Documents."

The Katchalsky-Katzir stamp

New Israeli Stamp Honors Polymer Chemist

Henryk Eisenberg of the Weizmann Institute, Rehovoth, Israel, sent us a recently issued Israeli stamp honoring Aharon Katchalsky-Katzir (1913–1972), a scientist born in Poland who studied at the Hebrew University of Jerusalem, where he coauthored a guide to the butterflies of Israel. At the Weizmann Institute of Science he founded the polymer research department and studied muscle activity, membranes, and irreversible thermodynamics as applied to life processes. He was a brilliant classroom lecturer and also lectured frequently on the radio and in settlements, until his tragic death in an attack on Ben Gurion airport.

Other Recent Publications

Biography and Autobiography

Sheldon M. Atlas; Eli M. Pearce; F. R. Eirich, eds. *Polymers to the Year 2000 and Beyond: A Memorial Symposium for Herman F. Mark.* New York: Interscience / John Wiley & Sons, 1993. With reminiscences by Herbert Morawetz, Charles C. Price, Richard S. Stein, Walter Stockmayer, and others.

Otto T. Benfey; James J. Bohning; Arnold Thackray. "Arnold Beckman and His Instruments: Gatekeepers to the Mysterious World of Molecules." Pages 116–132 in *First 'Mineralkontor' International Conference on the History of Chemistry and Chemical Industry.* Budapest: Museum for History of Technology, Technikatörténeti Szemle XIX (Review of history of technology), 1992.

Jean Bernard; Jean-François Lemaire; Jean-Pierre Poirier, eds. *Marat homme de science?* Paris: Les Empêcheurs de Penser en Rond, 1993.

William H. Brock. "Liebig on Toast." *Chemistry & Industry* (20 Sept. 1993), 718.

Arthur Donovan. *Lavoisier: Science, Administration, and Revolution in Eighteenth-Century France.* Oxford: Blackwell, 1993.

Kenne Fant. *Alfred Nobel: A Biography.* New York: Arcade, 1993.

Michelle Goupil; Patrice Bret; Francine Masson, eds. *Lavoisier et la révolution chimique.* Paris: SABIX [Société des Amis de la Bibliothéque de l'Ecole Polytechnique], 1992.

Albert P. Heiner. *Henry J. Kaiser: Western Colossus.* San Francisco: Halo Books, 1991.

James G. Hershberg. *James B. Conant: Harvard to Hiroshima and the Making of the Nuclear Age.* New York: Alfred A. Knopf, 1993.

Frederic L. Holmes. *Hans Krebs.* Vol. 2: *Architect of Intermediary Metabolism, 1933–1937.* New York: Oxford University Press, 1993. See the review of Vol. 1 in *Chemical Heritage* 10:2 (Summer 1993), 16.

David M. Knight. *Humphry Davy: Science and Power.* Cambridge: Blackwell, 1992. See the editorial in this issue, p. 2.

Wyndham D. Miles; Robert F. Gould. *American Chemists and Chemical Engineers.* Vol. 2. Guilford, Conn.: Gould Books, 1993.

Leonello Paoloni, ed. *Lettere a Stanislao Cannizzaro, 1863–1868.* Palermo, Italy: Facoltà di Scienze, Università di Palermo, 1993.

Analytical Chemistry; Environmental Chemistry; Instrumental Techniques

D. T. Burns. "Some Aspects of the History of Education in Analytical Chemistry: Published Syllabi and Their Authors, Shaw (1734), Watson (1771), Moyes (1784, 1786), and Sullivan (1856)." *Fresenius' Journal of Analytical Chemistry* 347 (Sept. 1993), 14–18.

S. Debarbat; A. E. Ten, eds. *Mètre et système métrique.* Paris: Observatoire de Paris, 1993.

Boelie Elzen. "The Failure of a Successful Artifact: The Svedberg Ultracentrifuge." Pages 347–377 in *Center on the Periphery: Historical Aspects of 20th-Century Swedish Physics,* ed. Svante Lindqvist. Canton, Mass.: Science History Publications, 1993.

G. Hildebrandt. "The Discovery of the Diffraction of X-Rays in Crystals: A Historical Review." *Crystal Research and Technology* 28 (1993), 747–766.

Ferenc Szabadváry. *History of Analytical Chemistry.* Reading, Berks.: Gordon & Breach Science Publishers, 1992. Reprint of 1966 edition.

Chemical Industry; Chemical Engineering; Chemical Technology

Growing Orbit: The Story of FMC Corporation. Chicago: FMC Corporation, 1992.

George J. Binczewski. "A Monumental Point: World's First Big Aluminum Casting." *Light Metals* (1993), 723–730. On casting the peak of the Washington Monument.

Paul R. Jones. "Justus von Liebig, Eben Horsford, and the Development of the Baking Powder Industry." *Ambix* 40 (1993), 65–74.

George B. Kauffman; Isaac Mayo. "The Metal with a Memory." *American Heritage of Invention & Technology* 9(2) (Fall 1993), 18–23. On Nitinol.

E. R. Landa. "A Brief History of the American Radium Industry and Its Ties to the Scientific Community of the Early 20th Century." *Environment International* 19 (1993), 503–508.

J. C. Michaels. "Aniline in History and Technology." *Endeavour* 17 (1993), 121–126.

Herman Pines. *Genesis and Evolution of the Ipatieff Catalytic Laboratory at Northwestern University, 1930–1970.* Evanston, Ill.: Department of Chemistry, Northwestern University, 1992.

Herbert T. Pratt. "America's Oldest Dyehouse." *Textile Chemist and Colorist* 25(10) (1993), 18–23.

And Now for Something Completely Different

Tony Harrison. *Square Rounds.* London / Boston: Faber & Faber, 1992. 61 pp. $8.95.

Tony Harrison's new play *Square Rounds,* performed to acclaim at London's National Theater, is an irreverent romp through the history of chemistry. Its rhymes are outrageous, as in Clara (wife of Fritz) Haber's "Those nitrates you produced for fertilizer / Now serve the warlike purpose of the Kaiser." An earlier creator of fertilizer, Justus von Liebig, denounces the ecologic waste of the flush toilet, located on center stage: "England's green and pleasant land will be laid bare, / Because of the contraption inside that cabin there, / A disaster it has fallen upon us Germans to repair." Meanwhile, Sir William Crookes declaims a paean of praise for chemistry's creative potential: "At the Great Exhibition William Perkin the inventor / Showed crude coal tar makes marvelous magenta."

Gases are central to the play, which includes song-and-dance routines and magical transformations. Nitrogen's ubiquity and inaccessibility, laughing gas, chlorine, mustard gas, and zyklon B all have their place, as do the brothers Hiram and Hudson Maxim of the machine gun and smokeless powder.

A mention of the green of undergarments suggests that the author is even aware of Friedrich Wöhler's spoof of Jean-Baptiste Dumas's substitution theory, predicting fibers made only of chlorine. His breadth of knowledge becomes even more remarkable in the appearance of Chinese musicians in the finale, telling of the early Chinese exploration of explosives, gases, and rockets, the last made possible by the hollow compartments of bamboo: "From one tube of wood comes the bad and the good / The music that gladdens the heart, / The haunting sweet flute and something to shoot / A projectile that blows you apart."

Not exactly a book for the coffee table, but perhaps one to have at the bedside.

———. "The Joys of Problem Solving." *Textile Chemist and Colorist* 25 (Feb. 1993), 21–24. The Olney Medal address.

Ken Reese. "Crackers: How Refiners Learned to Wring More Gas from Crude." *Today's Chemist At Work* (Nov./Dec. 1993), 59–60.

Carsten Reinhardt. "Über Wissenschaft und Wirtschaft: Fritz Habers Zusammenarbeit mit der BASF 1908 bis 1911." Pages 287–315 in *Naturwissenschaft und Technik in der Geschichte,* ed. Helmuth Albrecht. Stuttgart: Verlag für Geschichte der Naturwissenschaften und der Technik, 1993.

Tony Travis. "Madder Red: A Revolutionary Colour." *Chemistry & Industry* (3 Jan. 1994), 28.

Hartmut Walravens, ed. *Ein blaues Wunder: Blaudruck in Europa und Japan.* Berlin: Akademie Verlag, 1993. On indigo dyeing and printing.

Organic, Biomedical, and Pharmaceutical Chemistry

Donglu Bai. "Traditional Chinese Medicines and New Drug Development." *Pure & Applied Chemistry* 65 (1993), 1103–1112.

D. H. R. Barton; S. I. Parekh. *Half a Century of Free Radical Chemistry.* Cambridge: Cambridge University Press, 1993.

John Beatty; Elizabeth Sandager. "Documenting the Human Genome Project: Experimental Challenges and Opportunities." *The Mendel Newsletter* (Nov. 1993), 1–8.

Alberto Cambrosio; Daniel Jacobi; Peter Keating. "Ehrlich's 'Beautiful Pictures' and the Controversial Beginnings of Immunological Imagery." *Isis* 84 (1993), 662–699.

G. Curzon. "The History of Neurochemistry as Revealed by the *Journal of Neurochemistry.*" *Journal of Neurochemistry* 61 (1993), 780–786.

Nina Fedoroff; David Botstein, eds. *The Dynamic Genome: Barbara McClintock's Ideas in the Century of Genetics.* Cold Spring Harbor, N.Y.: Cold Spring Harbor Laboratory Press, 1992.

K. Y. Guggenheim. "Paracelsus and the Science of Nutrition in the Renaissance: On the Occasion of the 500th Anniversary of His Birth." *Journal of Nutrition* 123 (1993), 1189–1194.

Irene Jacob; Walter Jacob, eds. *The Healing Past: Pharmaceuticals in the Biblical and Rabbinic World.* Leiden / New York: E. J. Brill, 1993.

Saul Jarcho. *Quinine's Predecessor: Francesco Torti and the Early History of Cinchona.* Baltimore: Johns Hopkins University Press, 1993.

Lily E. Kay. "The Intellectual Politics of Laboratory Technology: The Protein Network and the Tiselius Apparatus." Pages 398–423 in *Center on the Periphery: Historical Aspects of 20th-Century Swedish Physics,* ed. Svante Lindqvist. Canton, Mass.: Science History Publications, 1993.

Joshua Lederberg. "What the Double Helix (1953) Has Meant for Basic Biomedical Science: A Personal Commentary." *Journal of the American Medical Association* 269 (1993), 1981–1985.

Daniel Lednicer, ed. *Chronicles of Drug Discovery.* Vol. 3. Washington, D.C.: American Chemical Society, 1993.

Continued on next page

Frieder W. Lichtenhaler. "Emil Fischer's Proof of the Configuration of Sugars: A Centennial Tribute." *Angewandte Chemie,* International Edition, 31 (1992), 1541–1556.

Bruce Merrifield. *Life During a Golden Age of Peptide Chemistry: The Concept and Development of Solid-Phase Peptide Synthesis.* (Profiles, Pathways, and Dreams, Jeffrey I. Seeman, Series Editor.) Washington, D.C.: American Chemical Society, 1993.

Peter J. T. Morris. "Following What's Fun To Do." *Chemistry & Industry* (20 Dec. 1993), 1010. On Karl Ziegler.

Ingrid Pieroth. *Penicillinherstellung: Von den Anfängen bis zur Grossproduktion.* Stuttgart: Wissenschaftliche Verlagsgesellschaft, 1992. A Ph.D. dissertation on penicillin in Germany, Great Britain, and the United States.

Percy Reboul. "Plastics: The Early Days." *Chemistry & Industry* (6 Sept. 1993), 674.

G. P. Schiemenz. "A Heretical Look at the Benzolfest." *British Journal for the History of Science* 26 (1993), 195–205.

Harkishan Singh. *History of Pharmacy in India and Related Aspects.* Vol. 1: *Pharmacopoeias and Formularies.* Delhi: Vallabh Prakashan, 1994.

Esmond E. Snell. "From Bacterial Nutrition to Enzyme Structure: A Personal Odyssey." *Annual Review of Biochemistry* 62 (July 1993), 1–27.

Theodore L. Sourkes. "How Thudichum Came to Study the Brain." *Journal of the History of Neuroscience* 2 (1993), 107–119.

———. "John Simon, Robert Lowe, and the Origin of State-Supported Biomedical Research in Nineteenth-Century England." *Journal of the History of Medicine and Allied Sciences* 48 (1993), 436–453.

Elizabeth L. Watson. *Houses for Science: A Pictorial History of Cold Spring Harbor Laboratory.* Cold Spring Harbor, N.Y.: Cold Spring Harbor Laboratory Press, 1991.

Inorganic, Physical, and Theoretical Chemistry

Ana Carneiro. "Adolphe Wurtz and the Atomism Controversy." *Ambix* 40 (1993), 75–95.

Per Fridtjof Dahl. *Superconductivity: Its Historical Roots and Development from Mercury to the Ceramic Oxides.* New York: American Institute of Physics, 1992.

Norman Hackerman; Alan Campion. "Almost 50 Years of Physical Chemistry at the University of Texas." *Annual Review of Physical Chemistry* 44 (Nov. 1993), 1–12.

Erwin H. Hiebert. "Reflections on the Origin and Verification of the Third Law of Thermodynamics." Pages 90–138 in *Thermodynamics, History and Philosophy: Facts, Trends, Debates,* ed. K. Martinás, L. Ropolyi, P. Szegedi. New Jersey / London: World Scientific, 1991.

Keith J. Laidler. *The World of Physical Chemistry.* New York: Oxford University Press, 1993.

I. L. Preiss. "45 Years of Radiochemistry Education." *Journal of Radioanalytical and Nuclear Chemistry* A 171 (1993), 193–202.

F. Gordon A. Stone. *Leaving No Stone Unturned: Pathways in Organometallic Chemistry.* (Profiles, Pathways, and Dreams, Jeffrey I. Seeman, Series Editor.) Washington, D.C.: American Chemical Society, 1993.

Alchemy and Chemistry through the Eighteenth Century

Martha Baldwin. "Alchemy and the Society of Jesus in the Seventeenth Century: Strange Bedfellows?" *Ambix* 40 (1993), 41–64.

Bernadette Bensaude-Vincent. *Lavoisier: Mémoires d'une révolution.* Paris: Flammarion, 1993.

Udo Benzenhöfer. *Paracelsus.* Darmstadt: Wissenschaftliche Buchgesellschaft, 1993.

Marco Beretta. *The Enlightenment of Matter: The Definition of Chemistry from Agricola to Lavoisier.* Nantucket, Mass.: Science History Publications, 1993.

Antonio Clericuzio. "From Van Helmont to Boyle: A Study of the Transmission of Helmontian Chemical and Medical Theories in Seventeenth-Century England." *British Journal for the History of Science* 26 (1993), 303–334.

Robert Opferkuch. "Chemische und metallurgische Aspekte der Alchemie." *Mitteilungen der Gesellschaft Deutscher Chemiker: Fachgruppe Geschichte der Chemie* No. 9 (1993).

Lawrence Principe. "Robert Boyle's Alchemical Secrecy: Codes, Ciphers and Concealment." *Ambix* 39 (1992), 63–74.

Documents

Sabine Ernst. *Lise Meitner an Otto Hahn: Briefe aus den Jahren 1912 bis 1924.* Stuttgart: Wissenschaftliche Verlagsgesellschaft, 1993.

General

Rima D. Apple; Phyllis Holman Weisbard, eds. *The History of Women and Science, Health, and Technology: A Bibliographic Guide to the Professions and the Disciplines.* 2nd ed. Madison, Wis.: University of Wisconsin System, Women's Studies Librarian, 1993. Lists over one hundred articles and books on women in the chemical and health sciences and technologies.

G. G. Devyatykh; S. V. Yankov. "Evolution of the Chemistry of High-Purity Substances." *High-Purity* 7(1) (1993), 1–8.

David Knight. "Chemistry and Metaphors." *Chemistry & Industry* (20 Dec. 1993), 996–999. On chemical language.

———. "The Evolution of Chemistry." *Chemistry & Industry* (19 July 1993), 545. On the European Science Foundation's four-year project "Evolution of Chemistry in Europe, 1789–1939."

John Mann. *Murder, Magic, and Medicine.* New York: Oxford University Press, 1992. A chemist looks at naturally occurring compounds and their uses.

P. S. Nagpaul; N. Pant. "Cross-National Assessment of Specialization Patterns in Chemistry." *Scientometrics* 27 (1993), 215–235.

Mary Jo Nye. *From Chemical Philosophy to Theoretical Chemistry: Dynamics of Matter and Dynamics of Disciplines, 1800–1950.* Berkeley / Los Angeles: University of California Press, 1993.

Ken Reese. "Gas! The Story of the Chemical Warfare Service." *Today's Chemist At Work* (Jul. / Aug. 1993), 40–41.

R. H. Thomson. "Chemistry at Aberdeen: The First 200 Years." *Chemistry in Britain* 29 (1993), 964–966.

AIChE—*continued from page 9*

when "designing" cellular reactors and constructing bioprocesses that incorporate the interaction of macroscale reactor design with cellular regulation. Finally, Arindam Bose (Pfizer) discussed the evolution of experimental facilities for bioprocess scale-up.

In the next segment Harvey Blanch (Berkeley) reviewed the many chemical engineering contributions to current practice in product separation and recovery. He was followed by Alan Hatton (MIT), who discussed various new approaches to plant-scale separation of biochemical and biological products. Hatton foresees that traditional methods will still be used but that "upstream" and "downstream" activities will be better integrated and both selectivity and overall yield enhanced.

The symposium concluded with descriptions of two specific bioprocess engineering accomplishments. Robert Giorgio (Life Sciences International) discussed the evolution of aseptic and sterile processing technology, and Geoffrey Slaff (Synergen) described the successful scale-up of a process to produce a ribosomal DNA (rDNA) product, anakinra, a human therapeutic protein.

The program was closed by Arthur Humphrey (Penn State; AIChE president for 1993), who offered his views on the future role of chemical engineering in biotechnology.

CHF's traveling exhibit "Structures of Life" was on show at the meeting, and its brochure "The First Century of Chemical Engineering: A Timeline of Discoveries and Achievements" was distributed. (This timeline, especially created for AIChE's 85th anniversary, is available from CHF.)

ELMER L. GADEN, JR.
University of Virginia

To Clinical Chemists Overseas

The new AACC publication *History* is appealing to foreign readers to write on the history of clinical chemistry in their country. Contact Dr. Samuel Meites, Children's Hospital, Clinical Chemistry Laboratory, 700 Children's Drive, Columbus, OH 43295.

CHEMICAL ANNIVERSARIES

Christopher K. Ingold (3), later Sir Christopher, surrounded by his undergraduate and graduate students and colleagues, soon after their return to London from Aberystwyth in 1944. (1) Francesca Leake (later Garforth), leading British chemist-educator; (2) Samuel Fowden (University College, London); (4) Ronald J. Gillespie (McMaster University, Canada); (5) Theodor Benfey; (6) Stephen Awokoya, later head of science education, UNESCO, then Western Nigeria Minister of Education; (7) George Kohnstam (University of Durham).

C. K. Ingold, Master and Mandarin

They came from near and far to work with him at University College, London—and in Aberystwyth, Wales, during the war years 1939–1944. He charmed or infuriated them—or both—but on all he left an indelible impression as he crafted the methods, language, and interpretations that would dominate organic chemistry for decades. Fifteen of his former students, colleagues, antagonists, and current chroniclers came to the fall ACS meeting in Chicago to pay tribute to Christopher Kelk Ingold (1893–1970) on the centennial of his birth. The occasion was a symposium, "C. K. Ingold: Master and Mandarin of Physical Organic Chemistry," organized by Derek A. Davenport (Purdue) and Martin D. Saltzman (Providence College, Rhode Island). In the audience was another Ingold student, Kenneth T. Leffek (Dalhousie University, Canada), who is writing Ingold's biography—a daunting task since most of Ingold's personal papers were destroyed after his death.

Keith U. Ingold (National Research Council, Canada), distinguished chemist son of the elder Ingold (CKI), led off the two-day celebration with "Homolysis, Even between Consenting Adults, Is Grounds for Instant Dismissal from This Department." The title, we learned, was created by CKI himself. The speaker's major scientific preoccupation has been with free radicals, which CKI attempted to show had no place in organic chemistry. CKI made it abundantly clear that even when a simple molecule such as isopropyl chloride reacts, it may ionize in suitable and not uncommon circumstances into an organic cation and the chloride ion.

Besides emphasizing ionic as opposed to "homolytic" or symmetric breaking of bonds, Ingold fought strenuously against interpretations involving steric (i.e., volume and crowding) effects—this battle being vividly described by Purdue's Herbert C. Brown.

When Ingold ventured into the field of inorganic reaction mechanisms, he became involved in a controversy with Ralph G. Pearson and Fred Basolo (Northwestern University), which had the salutary effect of markedly increasing chemists' interest in inorganic mechanisms.

Four speakers from the Aberystwyth exile participated: Clifford A. Bunton (University of California, Santa Barbara) and three former students whose undergraduate organic laboratory work Bunton supervised—Theodor Benfey (CHF), Ronald J. Gillespie (McMaster University, Canada), and Henry J. Shine (Texas Tech University).

Mary Jo Nye (University of Oklahoma) described the Paris school of organic reaction mechanisms in the 1920s and 1930s, work that was eclipsed by Ingold's quick domination of the field. John D. Roberts (Caltech) surveyed physical organic chemistry in the United States at the time. Derek H. R. Barton (Texas A&M), spanning both sides of the Atlantic, recalled his own interactions with Ingold, Robert Robinson, Saul Winstein, and Robert B. Woodward. Moving into the Southern hemisphere, Thomas M. Dunn (University of Michigan) reminded us that Ingold imported a whole series of chemists from Australia, including Ronald S. Nyholm and Dunn himself.

The impact and fate of Ingold terminology was the topic of Joseph F. Bunnett (University of California, Santa Cruz). We owe to Ingold not only the mechanistic vocabulary of *nucleophile, electrophile, mesomerism, SN1, SN2, E1,* and *E2*, but also the way we now distinguish between right- and left-handed geometry in molecules via the *R* and *S* designations worked out by Ingold with Robert S. Cahn and Vladimir Prelog.

Two speakers pointed to Ingold's contributions outside chemical research—Gerrylynn K. Roberts (Open University, UK), who described his innovative role as educator and administrator, and Benfey, who pointed to Ingold's impressive

Continued on next page

100

Ingold circa 1921. Courtesy Chemistry Department, University College, London.

Ingold was a committed mountaineer always ready to learn new athletic skills. In 1966, at age 72, he tried water skiing on a visit to his son Keith in Canada. Courtesy Keith U. Ingold.

Leo Baekeland's Bakelizer, the first National Historic Chemical Landmark. At the unveiling of the landmark plaque were Arthur P. Molella (left) of the National Museum of American History, Jeffrey L. Sturchio of Merck & Co., chair of the ACS Division of History of Chemistry, and Helen M. Free, ACS president. Courtesy Chemical & Engineering News.

INGOLD—*continued*

mastery of chemical history. CKI's undergraduate lectures and his "Structure and Mechanism in Organic Chemistry" (Ithaca, N.Y.: Cornell Univ. Press, 1953) presented his researches in their historical setting, thereby clarifying the evolution of many parts of chemistry. By his example he may also have influenced others to lecture in this way, and may even have led some to pursue research in chemical history, as at least three of his students have done: William H. Brock (University of Leicester), Davenport, and Benfey.

The *Bulletin for the History of Chemistry* plans to cover the symposium and will publish several of the papers.

Ingold Meeting at the University of Southampton

Although the centenary of Sir Christopher Ingold's birth did not fall until 28 October 1993, the Historical Group of the Royal Society of Chemistry held an Ingold Symposium six months earlier. That date was chosen to coincide with the annual RSC Congress held last April at the University of Southampton—the former Hartley College, where Ingold received his undergraduate education.

Edward Cartmell, who spent his career at Southampton after working with Ingold in the 1930s, described Hartley College and the training Ingold received there before World War I. William H. Brock looked at the education of Edith Hilda Usherwood (1898–1988), the chemical research she did prior to her marriage to Ingold in 1923, and their chemical partnership until their children arrived. Her husband then began his collaboration with Edward D. Hughes, which continued until the latter's death in 1963. Margaret Farago recalled her experiences as a graduate student at University College, London, in the 1950s, when she was working on inorganic reaction mechanisms. This included an embarrassing episode when she was a new graduate student: Ingold seized upon some of her experimental results as of great theoretical significance, and she had to confess the next day when her results turned out to be spurious.

John Green of UCL then reviewed Ingold's use of "long wave" (infrared and Raman) spectroscopy in the 1920s and 1930s for the study of a number of chemical problems, including the structure of benzene. He noted that Edward Teller, who was briefly at UCL in 1934, made a fundamental contribution to Ingold's work with a theorem for the frequency relations of isotopically substituted molecules. Green stressed how Ingold's thirty-year structural program complemented his work on organic reaction mechanisms. Finally, Gerrylynn Roberts of the Open University revealed a little-known side of Ingold, showing him as an innovative head of department and educator who always stressed the unity of chemistry and whose broad interests exemplified it. Green and Roberts are currently planning a history of the UCL chemistry department.

WILLIAM H. BROCK
University of Leicester

BAKELIZER—
Continued from page 1

finds. The ACS Public Outreach Office coordinates the procedure for submitting nominations and keeping them moving through the process, and an advisory committee considers which nominations merit designations as historic chemical landmarks.

"Our hope is that the ACS landmarks program will become a source of pride to everyone in the chemical professions. Through the documentation it will generate on specific landmarks, it will encourage educators and museum curators to incorporate chemistry into their teaching. By catalyzing interest in chemical milestones, we can spark inspiration in students and encourage public understanding of the contributions chemists and chemical engineers make to everyday life."

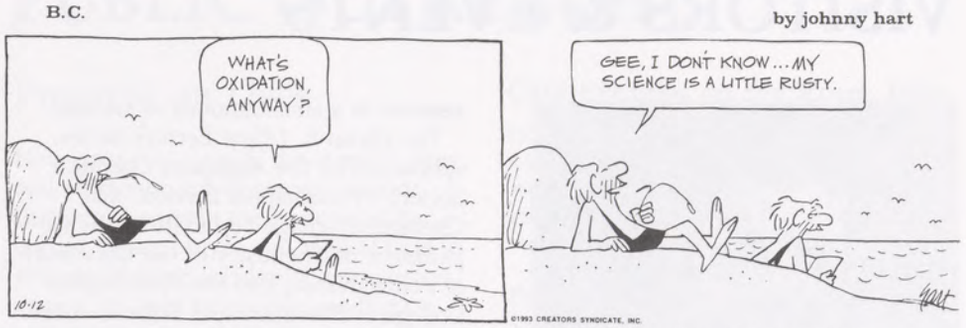
A bronze landmark plaque was accepted by the Smithsonian's Arthur P. Molella, who also heads the team working on the major Science and American Life exhibit that will open at the museum in April of 1994. Jeffrey L. Meikle of the University of Texas presented a synopsis of the discovery of Bakelite and its commercialization in the manufacture of many items in every day life, from jewelry to radios. Meikle's presentation was enhanced by a dazzling slide performance using images manipulated by the latest computer technology.

The NHCLP Advisory Committee has already approved two more landmark designations, to be conferred in 1994.

JAMES J. BOHNING

CHF's Chemical Dateline for 1994

In this issue we inaugurate CHF's annual Chemical Dateline. We ask our readers to send us important events (and their sources) in their areas of expertise which we missed, for publication in our winter issue. Even more we need information for compiling our next dateline, for 1995, and eagerly await your help. Information on significant anniversaries in chemical engineering and chemical industry is especially welcome.



In commemoration of the bicentennial of the death of Antoine Lavoisier. Reproduced by permission of Johnny Hart and Creators Syndicate, Inc.

500 YEARS AGO
1494

Agricola (Georg Bauer), author of *De Re Metallica,* is born on 24 March.

350 YEARS AGO
1644

Johannes Baptista van Helmont, famous for his experiments with willow trees and gases, dies on 30 December.

200 YEARS AGO
1794

Antoine Laurent Lavoisier, creator of the oxygen theory of combustion and rusting, is guillotined on 8 May.
Alessandro Volta proposes that electricity from two metals in contact via a liquid causes twitching of frog legs.
John Dalton, known for his atomic theory, describes color blindness.
Johan Gadolin discovers yttrium.
Eilhard Mitscherlich, discoverer of isomorphism, is born on 7 January.

150 YEARS AGO
1844

John Dalton dies on 27 July.
Justus Liebig's *Chemische Briefe* (from alchemy, atoms, and isomerism to industry, physiology, dietetics, and fertilizers) is published.
Harvey Wiley, "Father of Pure Food Laws," is born on 18 October.

125 YEARS AGO
1869

Dmitri Ivanovich Mendeleev publishes the periodic table of the elements.
John Wesley Hyatt develops celluloid.

100 YEARS AGO
1894

Herman Frasch mines sulfur with superheated water.
Carl S. Marvel, polymer pioneer, is born on 11 September.
William Ramsay discovers argon.
The American section of the **Society of Chemical Industry** is founded.

50 YEARS AGO
1944

Leo Hendrik Baekeland of Bakelite fame dies on 23 February.
Thomas Midgley, Jr., known for his studies on tetraethyl lead and the chlorofluorocarbons, dies on 2 November.
Dow-Corning begins industrial-scale production of silicones.
Hudson Talcum Powder Company commercializes the first polyethylene squeeze bottle.
Glenn Seaborg discovers americium and curium.
A. J. P. Martin and **R. L. M. Synge** develop paper chromatography.
Lewis H. Sarrett synthesizes cortisone at Merck Sharp & Dohme.

25 YEARS AGO
1969

George Pimentel announces the presence of methane and ammonia near Mars.

Paracelsus at 500

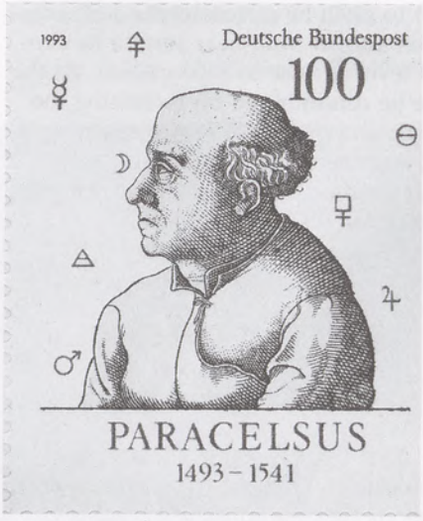
We may be a bit late in celebrating the birth half a millennium ago of Paracelsus (1493–1541), but the following nuggets of information should help remedy that oversight.

■ Leopold May of Washington, D.C., wondered why we had not so far mentioned the anniversary. He sent us part of Paracelsus's self-composed epitaph: "Here lies buried Philip Theophrastus, the famous doctor of medicine, who cured wounds, leprosy, gout, dropsy, and other incurable diseases of the body with wonderful knowledge and who gave his goods to be divided and distributed among the poor."

■ John Hudson of Cambridge, England, wrote "A Tribute to a Sixteenth Century Iatrochemist" for *Chemistry and Industry* (4 Oct. 1993, p. 759), pointing to Paracelsus's influence in turning alchemical practice toward medical problems, using chemicals rather than plant materials to cope with diseases.

■ Allen Debus of the University of Chicago spoke on "Paracelsus and His Significance for Medical Science" at two sites: the National Library of Medicine and Hahnemann University in Philadelphia. Debus argued that Paracelsus was important to the Scientific Revolution of the sixteenth and seventeenth centuries, particularly for his emphasis on empirical work rather than theory and on the need to reform scientific education.

The National Library also put an exhibit, "The Paracelsian Revolution in Medicine," on view. Hahnemann University, in keeping with its history, has an impressive collection of Paracelsian writings. Paracelsus's doctrines were influential in the development of homeopathic medicine.



Theophrastus Bombast von Hohenheim, who called himself Paracelsus, helped alchemy turn towards urgent humanitarian tasks. Here he is depicted with alchemical symbols on a German stamp issued in 1993.

VISITORS & EVENTS

Bassam Shakhashiri, former head of science and engineering education at NSF, was the 1993 Ullyot lecturer.

Bassam Shakhashiri Dazzles Ullyot Audience

Bassam Z. Shakhashiri of the University of Wisconsin was eminently qualified to speak on the topic he chose as the most recent Ullyot Public Affairs Lecturer: "Enhancing the Quality of Science Education in the United States." While head of science and engineering education at the National Science Foundation from 1984 to 1990, he increased the NSF education budget from near zero to its current level of close to $600 million. At the time he concentrated on increasing the supply and quality of future scientists and engineers, but his current concern is for a national commitment to science literacy for all. He feels that the economic threat to America today is far more serious than in the Sputnik era and requires an appreciation and understanding of science and of the benefits of technology on the part of all citizens.

To educate our citizenry more broadly means making science interesting and fun. That in turn requires imaginative approaches—such as chemical demonstrations that are both instructive and spectacular. Shakhashiri presented several such demonstrations, among them effecting amazing color changes with slight changes in pH and dissolving surprisingly large amounts of Styrofoam peanuts in a small amount of acetone.

The Glenn E. Ullyot Lecture Series, sponsored by the American Chemical Society's Philadelphia Section, the Chemical Heritage Foundation, the Department of Chemistry of the University of Pennsylvania, and the Philadelphia College of Pharmacy and Science, was established by Glenn E. Ullyot, who for many years was associated with SmithKline Laboratories.

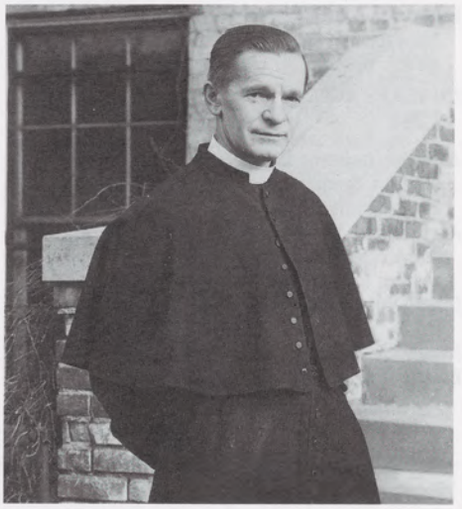
Abe Zoss's Chemical Ventures and Adventures

At a CHF Conversazione, Abraham O. Zoss, former president of the American section of the Société de Chimie Industrielle, told of his chemical life and work. Abe Zoss majored in chemical engineering at Notre Dame University, then took his Ph.D. in organic chemistry there as a member of the acetylene group originally headed by Father Julius A. Nieuwland. Some of the reactions Nieuwland had discovered were explored by Wallace A. Carothers and others at Du Pont in work that led to the discoveries of a synthetic drying oil and of Neoprene rubber.

Zoss joined General Aniline and Film (GAF), where he studied how to produce vinyl ethers and their polymers using high-pressure acetylene reactions. After World War II he was sent to Germany by the Office of Technical Services of the U.S. Department of Commerce, to investigate Walter Reppe's extensive acetylene and polymer discoveries at BASF. Zoss finally located the man himself, once he learned that Reppe was in a U.S. Army prison—accused of smuggling notebooks to the Russians.

Zoss directed work on cigarette filters while at Celanese Corporation and also sought a nontoxic smoking material. He gained much international experience by collaborating with the British consortium ICI. In 1972 he became a vice president at Engelhard Industries, where he was involved with the automotive catalytic converter and with platinum complexes used as antitumor drugs. Since 1984 he has been president of the consulting firm of Business Development International, where international technology transfer is one major activity.

Pointing to the continuity of chemists' work, Abe concluded, "Old chemists never die, they just reach equilibrium."



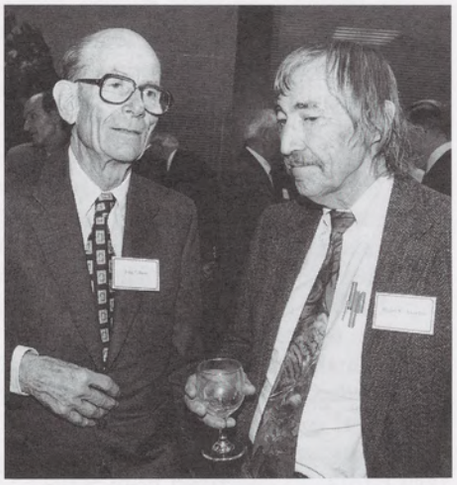
Father Julius A. Nieuwland of Notre Dame was a pioneer of acetylene chemistry. Courtesy Du Pont Hayden Collection.

Abe Zoss, seen here chatting with Charles Price, told CHF of his acetylene and other chemical adventures.

PUBLIC OUTREACH

Charlie Price at Eighty 80

Before the fall meeting of the CHF Board of Directors, the board was joined by a group of fifty-year members of the American Chemical Society, the chemistry faculty of the University of Pennsylvania, and CHF's staff and other friends in honoring Charles C. Price, chair of the board, on his eightieth birthday. Arnold Thackray, in presenting Price with a Wedgewood cameo of Joseph Priestley, pointed to his many accomplishments—as chemist, Penn department head, polymer inventor, president of the American Chemical Society (where he spearheaded its work on chemists' relations to society), and head of the United World Federalists—and to his dedicated service to CHF.



Among the friends honoring Charlie were John C. Haas of Rohm and Haas and Stuart W. Churchill, former AIChE president.

Progress on Dyes

How does one recount the story of dyes and pigments and their uses, a story that stretches from the ancient production of Tyrian purple and biblical blue to William Perkin's accidental discovery of mauve, its later large-scale production, and its offspring, the explosives and pharmaceutical industries—and on to the new dyes of ever-more-captivating hues that serve new fibers, new tastes, and the ever-new needs of our time? To tell that story is CHF's latest challenge. With major assistance from the Edelstein Center for the History and Philosophy of Science, Technology, and Medicine in Jerusalem, CHF is gearing up to create its newest traveling exhibit, "Colors, Culture, and the Chemical Sciences."

The major part of the exhibit text is being drafted by Tony Travis, deputy director of the Edelstein Center and author of *The Rainbow Makers*, the definitive study of the rise and development of the synthetic dyestuffs industry in Western Europe. Much of the graphic material for the exhibit will come from the Sidney M. Edelstein Library associated with the Edelstein Center. To develop the American part of the story in detail, Susan Speaker, a recent University of Pennsylvania Ph.D., will work with CHF's Theodor Benfey. Benfey and Travis together will direct production of the exhibits.

In October Travis visited the Beckman Center to confer with CHF's staff, where he also participated in the Penn Chemical Engineering Centennial.

CHF Exhibits on the Road: 1994

Our traveling exhibits are becoming widely known, and reservations need to be made early. The only cost is that of return shipping. Write to Exhibits at the Chemical Heritage Foundation.

Exhibit itineraries for 1994 are as follows:

Polymers and People
1–15 October: Arco, Monaca, PA

Structures of Life
29 May–2 June: Canadian Chemical Conference, Winnipeg, Manitoba, Canada
15–31 October: University of Missouri, Columbia, MO
5–30 November: Las Cruces Natural History Museum, Las Cruces, NM

Woodward and the Art of Organic Synthesis
15 May–30 June: Joint Meeting of the ACS Great Lakes Region and Central Region, University of Michigan, Ann Arbor, MI
24 July–7 August: ACS Division of Chemical Education 13th Biennial Conference, Bucknell University, Lewisburg, PA
27 September–3 October, Department of Chemistry, SUNY Stony Brook, Stony Brook, NY
15–31 October: University of Missouri, Columbia, MO
7–30 November, East Stroudsburg University, East Stroudsburg, PA

From Our Far-Flung Correspondents

What's so special about electricity? Symmetry suggests that in addition to electronic conductors there should be proton conductors. Twenty years ago suggestions were made and experiments attempted to create proton currents in ion-exchange resins (See T. Benfey,

Continued on next page

Arnold Thackray presents the Priestley cameo to Charles C. Price. In the background are some of the posters created by chemistry students for National Chemistry Week, depicting the role of chemistry in modern life.

Tony Travis, Deputy Director of the Sidney Edelstein Center in Jerusalem, compares notes with then Edelstein Fellow William H. Brock and his wife, Elvina, after the Connor lecture (see p. 28).

CORRESPONDENTS—*continued*

Chemistry, 47 [June 1974], 3; and Ariadne, *New Scientist*, 31 Jan. 1974, end page). Reacting to the story "Ionic Conducting Polymers—Born Twenty Years Ago" in our last issue (11:1, Winter 1993–94, p. 2), **Walter Juda** of the chemical engineering department of Tufts University wrote us that forty years ago (28 April 1953) he patented a process (patent 2636851) using ion-exchange resins in rod, tube, sheet, or membrane form which allow transmission not only of protons but also, if suitably modified, of other cations or anions. Juda made the discovery at Harvard in 1948, with his assistant Wayne McRae. In late 1948 Juda founded Ionics Incorporated, now listed on the New York Stock Exchange.

Peter V. Wright, who with David E. Fenton created the *polymer electrolytes* (as they have come to be known) that our story described, in response pointed to the difference between Juda's discovery and theirs. "Ion exchange resins . . . are used in the presence of *aqueous electrolytes* . . . to provide a molecular scaffolding to which ionic functions may be attached. . . . [I]on *transport* takes place via an aqueous medium. . . . [T]he aqueous solvent permeates the polymer structure." Wright and Fenton's polymer electrolytes by contrast need no solvent: ions hop between sites. These electrolytes are being used in thin-film solid-state devices in which water would be disastrous.

Last word on standard pressure. As to the partial answer in our last issue (p. 20) to our earlier query on the source of 760 mm as standard pressure, **Jean Bartz Scurlock** of Kansas City, Missouri, cleared up the last puzzling discrepancy. The official definition specified 45° as the latitude, whereas Pierre Laplace had said 50°. Scurlock has now discovered that Laplace used different units—dividing a right angle by 100° instead of 90°. Hence his 50° is our 45°.

Course X again. In reference to the chemical engineering stories in our last issue (p. 18), **M. J. Shnitzler** of Brookline, Massachusetts, identified himself as one of the few remaining students in Course X at MIT in 1933, with Warren K. Lewis as one of the professors. He concluded his letter: "I have directed a few youngsters into Chem. Engineering. My clinching statement was—you can teach a chemist engineering easily but to teach an engineer chemistry was a formidable task." Do our readers agree?

Herman Mark displays Staudinger's rigid-rod model (left) of polymers and his own flexible model. When Mark showed Staudinger the latter, he "threw it in a corner [laughter]." From Herman Mark, oral history, CHF; courtesy James J. Bohning.

ACS Session on Herman F. Mark and Cellulosics

The great polymer pioneer Herman Mark made his mark in numerous fields, among them cellulose chemistry. At the fall ACS meeting in Chicago, the Division of Cellulose, Paper, and Textiles paid homage to its former chairman in a memorial symposium on cellulosics. As Jett C. Arthur, Jr., pointed out in his introductory remarks, Mark in 1921 was among the first to apply the new X-ray diffraction method to cellulosic fibers. He came to Canada in 1938 to look into the possibility of turning wood into textile fibers.

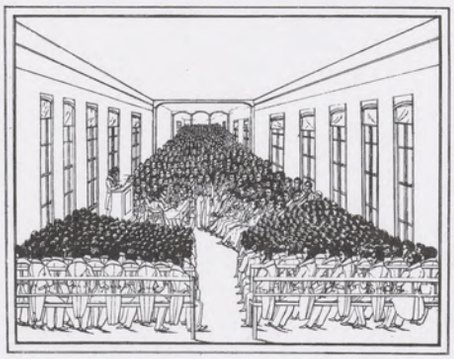
Eli M. Pearce of the Polytechnic University told the story of its Polymer Research Institute, founded by Mark, while James J. Bohning (CHF) recounted Mark's prior life and career in "From Berlin to Brooklyn," telling of his European and Canadian contributions to cellulose and textile fibers. His paper, based on extensive conversations with Mark that became part of the oral history now deposited at CHF, told of three momentous shifts in Mark's career. After completing his studies in his birthplace, Vienna, he moved to Berlin, first to assist organic chemist Wilhelm Schlenck and, within a year, to join at Fritz Haber's invitation the newly established Kaiser Wilhelm Institute of Fiber Chemistry. There he used X-ray diffraction to elucidate fiber structures, working under Michael Polanyi. He also helped Albert Einstein confirm the Compton effect, which in turn confirmed Einstein's quantum theory.

Haber urged him to attend the 1926 Düsseldorf confrontation between Hermann Staudinger and his critics which Yasu Furukawa described from Staudinger's side in our last issue (11:1; pp. 4–6). In CHF's oral history we have Mark's recollections of the same event. He reported that at that time X-ray evidence could neither confirm that chain molecules of high molecular weight existed nor prove that they did not.

A few months before that meeting, Mark was invited to join IG Farben's efforts to compete in the international fibers market. It was the second momentous career shift, terminated by Nazi disapproval of his Jewish ancestry. He moved to Vienna, was arrested there by the Nazis, yet managed to emigrate to Canada—taking valuable platinum with him shaped as ordinary coat hangers. There he joined the Canadian Pulp and Paper Company as director of its research laboratory in Hawkesbury, Ontario. In 1940 he made one final move—to Brooklyn Polytechnic Institute, now Polytechnic University.

An Ercker extra. Our mention a year earlier (10:1, Winter 1992–93, p. 12) of Cyril Stanley Smith's gift to the Othmer Library of an early edition of Lazarus Ercker's mining and mineralogy classic led **Hans Jenemann** of Hochheim, Germany, to inform us that the work was translated into modern German in 1960 by Paul Reinhard Beierlein, as *Beschreibung der Allervornehmsten Mineralischen Erze und Bergwerksarten vom Jahre 1580* (Akademie Verlag, Berlin). Jenemann included a timeline from the book spanning Ercker's life and listing political and technical benchmarks of the period.

MEETINGS



ASBMB National Meeting, Washington, D.C., 15–19 May 1994.

Electrochemical Society Spring National Meeting, San Francisco, California, 22–27 May 1994.

ASMS Annual Meeting, Chicago, Illinois, 29 May–3 June 1994.

49th ACS Northwest Regional Meeting, Anchorage, Alaska, 17–19 June 1994.

Includes the symposium "History of Chemistry in the Pacific Northwest." Contact Richard E. Rice, Department of Chemistry, University of Montana, Missoula, MT 59812; (406) 243-4022; fax (406) 243-4227.

7th BOC Priestley Conference, Bucknell University, Lewisburg, Pennsylvania, 24–27 June 1994.

Sponsored by British Oxygen Corporation, Royal Society of Chemistry, and American Chemical Society. Includes the symposium "The Early History of Ozone," with papers by William H. Brock, Peter J. T. Morris, Alan Rocke, and others, and a bicentennial celebration at the Priestley House of Priestley's arrival in America. Contact Dianne B. Ruddy, ACS, (202) 872-4402.

AACC Annual Meeting, New Orleans, Louisiana, 17–21 July 1994.

Alpha Chi Sigma Annual Meeting, Minneapolis, Minnesota, 2–7 August 1994.

AIChE Summer National Meeting, Denver, Colorado, 14–17 August 1994.

Includes a symposium, "40 Years of Nuclear Chemical Engineering," organized by J. R. Hightower, Martin Marietta Energy Systems, P.O. Box 2003, Oak Ridge, TN 37831-7357; (615) 574-6777; fax (615) 574-6222.

208th ACS National Meeting, Washington, D.C., 21–26 August 1994.

HIST Program Chair: M. D. Saltzman, Department of Chemistry, Providence College, Providence, Rhode Island 02918; (401) 865-2298. Includes two symposia: "IUPAC: 75th Anniversary," organized by M. D. Saltzman; and "Archaeological Chemistry," organized by Mary Virginia Orna, College of New Rochelle, New Rochelle, NY 10809; (914) 854-5302.

SHOT Annual Meeting, Lowell, Massachusetts, 6–9 October 1994.

May include a symposium on dyes.

Electrochemical Society Fall National Meeting, Miami Beach, Florida, 9–14 October 1994.

AATCC International Conference and Exhibition, Charlotte, North Carolina, 11–14 October 1994.

Includes a symposium of general papers on the history of textile dyeing, printing, bleaching, and finishing, organized by Herbert T. Pratt, P.O. Box 12215, Research Triangle Park, NC 27709.

HSS–4S Joint Annual Meeting, New Orleans, Louisiana, 13–16 October 1994.

AIChE Annual Meeting, San Francisco, California, 13–18 November 1994.

209th ACS National Meeting, Anaheim, California, 2–7 April 1995.

For general papers sessions send title of paper by 1 November 1994 and four copies of abstract by 1 December 1994 to M. D. Saltzman (see address above).

Second "Mineralcontor" International Conference on the History of Chemistry and Chemical Industry, Keszthely, Hungary, 12–16 August 1995.

Organized by Ferenc Szabadváry, Hungarian Chemical Society, H-1027 Budapest, Fö u. 68, Hungary; phone 36-1-201-6883; fax 36-1-201-8056.

210th ACS National Meeting, Chicago, Illinois, 20–25 August 1995.

Includes two symposia: "75th Anniversary of the ACS Division of the History of Chemistry," organized by J. J. Bohning, Chemical Heritage Foundation, 3401 Walnut St., Philadelphia, PA 19104, (215) 898-1302; and "Centenary of the ACS Chicago Section," organized by J. J. Doheny, 3625 McCormick Ave., Brookfield, IL 60513.

INTERESTED IN FUTURE ISSUES? CHANGED YOUR ADDRESS?

If you have changed your address, or if you are not now on our mailing list, please detach and return this form.

Our list, compiled from diverse sources, inevitably shows duplication. If you receive more than one copy of *Chemical Heritage*, please pass the extra along to an interested friend or colleague.

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

PHONE _____

DOUBLE YOUR DOLLARS: Through the generosity of a Haas family trust and other friends, new and increased gifts will be matched one-to-one during our annual giving campaign. For more details on our annual and planned giving programs, please contact Irene I. Lukoff at (215) 898-3675.

I enclose a gift of $_____ in support of the work of the Chemical Heritage Foundation.

☐ My company has a matching-funds gift program.

MAIL TO
Chemical Heritage Foundation
Department 11-2
3401 Walnut Street
Philadelphia, PA 19104-6228 USA

Two Ralphs and a Centennial

100

For CHF the occasion was its second Ralph Connor Lecture; for the University of Pennsylvania it was Chemical Engineering's Centennial Week. CHF and Penn joined forces to invite Ralph Landau—Penn Chemical Engineering graduate, distinguished entrepreneur, and thoughtful scholar—to give CHF's Connor lecture as a highlight of the centennial celebrations last October.

Landau, now a consulting professor of economics at Stanford University with an Sc.D. from MIT, cofounded Scientific Design Inc., which, with its successors Halcon International and the Halcon SD group, has been the source for petrochemical technology in more than thirty countries.

In his wide-ranging lecture, "Strategy for Economic Growth: Lessons from the Chemical Industry," Landau examined the history of the chemical industry from the 1850s, focusing on its progress from early local successes to the dynamic competitive interactions of the modern global economy. Landau also noted Japan's use of astute cooperation between government and industry to effect a successful entry into that economy. Together with Nathan Rosenberg and David C. Mowery, Landau has edited *Technology and the Wealth of Nations* (Stanford, Calif.: Stanford University Press, 1992), a modern update of Adam Smith's *Wealth of Nations*.

The Connor Lecture, endowed by the William Penn Foundation and the Rohm and Haas Company, honors the memory of Ralph Connor (1907–1990). Connor was Landau's professor of organic chemistry at Penn; he became vice president for Research at Rohm and Haas, and later chaired its board.

For the lecture CHF mounted a special pictorial display of chemical engineering at the University of Pennsylvania and in the United States. Penn began offering courses in chemical engineering in 1893 and prides itself on having the oldest chemical engineering program in continuous operation in the country. CHF also distributed its new annotated timeline, *The First Century of Chemical Engineering*, a study of the achievements of the profession after the transformation of the chemical industry at the end of the last century.

J. Lawrence Wilson (far left), chairman of Rohm and Haas, introduced the speaker, seen here relaxing with Sheldon E. Isakoff, CHF Board vice chairman and former AIChE president (to the left of Landau).

CONTENTS 11:2

1 CHF Approaches Independence
1 ACS Unveils Historic Landmark
3 Editorial: A Chemical Renaissance?
3 CHF Loses a Friend
4 BIMOSI Conference Report
5 Brown-Bag Lunches
6 Grants & Awards
7 Dexter Award
8 When I First Met a Computer
9 AIChE and Biotechnology
9 Don Othmer's 90th
10 Gifts to Archives: Ames Project; AIC Archives; Ivory Flakes; G. N. Lewis
12 Found in the Othmer Library, V: Liebig
13 Rockefeller Archives
14 Diaries on Mustard Gas Research
15 Publications: Chemical Engineering at Texas; Clara Immerwahr; Hermann Kolbe—and More
21 Chemical Anniversaries: C.K. Ingold; Paracelsus
23 CHF's Chemical Dateline
24 Visitors & Events
25 Public Outreach
26 Herman Mark and Cellulosics
27 Meetings

Chemical Heritage (ISSN 0736-4555), an occasional publication of the Chemical Heritage Foundation, reports on CHF's activities and on other news of the history of chemistry, chemical engineering, and the chemical process industries. Address inquiries and information to the Editor, *Chemical Heritage*, 3401 Walnut Street, Philadelphia, PA 19104-6228 USA; tel. (215) 898-4896; fax (215) 898-3327.

Copyright © 1994 by the Chemical Heritage Foundation.

U.S. POSTAGE
PAID
NONPROFIT ORGANIZATION
HANOVER, PA 17331
PERMIT NO. 4

CHEMICAL HERITAGE FOUNDATION
3401 Walnut Street • Philadelphia, Pennsylvania 19104-6228 USA